# JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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## EDITORIAL NOTES—GAS, &c.

### Ready for the Gas-Fire Season.

SUCCEEDING torrid days, the chills of autumn weather have already come upon us with a rapidity that emphasizes the fall of the year. "Winter, lingering, chills the lap of May," says the poet. The early cold snap, say the gas-fire manufacturers and the suppliers of gas, does much more for the gas-fire business than any amount of chilling of the "lap of "May" by the lingering of winter. The low atmospheric temperatures coming on top of the high ones have already given the gas-fire season a good start; and it may be taken that this excellent beginning will continue, and will do more for the selling and hiring-out of gas-fires this side of Christmas than sharp weather afterwards. The present season also commences with, in its favour, the excellent experience with gas heating of the past few years. Popular favour has during these recent years been rolling towards gaseous fuel for room heating; and the "boom" has caused the manufacturers to be better prepared than ever with stocks of fires to meet the demand that will be made upon them in the course of the next few months. Unless the public requirement exceeds estimates, there ought to be no necessity to work at such high pressure in the gas-fire factories as has been found requisite the last winter or two. But with such an extensive scope for the supersession of solid fuel, and with such a general growth of the desire for comfort where means will allow, the demand for gas-fires must in a measure be an unknown quantity, and difficult of accurate gauging. This being so, it is impossible to speak with any definiteness as to what the season holds in store in the nature of demand; but that the business will have big dimensions there is not a shadow of doubt.

The makers of gas-fires, articles and advertisements in our columns have shown, are quite prepared for the winter's trading. They recognize the vast dormant potentiality there is for them in heating; and most gas suppliers are no less keenly alive to the fact that the development of this potential business relies not only on the efforts of the producers of the fires, but on their own in providing the gaseous fuel at a fairly low price. Economy in the ordinary household has more effect than subsidiary advantages; and in this resides the reason for solid fuels having such enormous sway in domestic practice. This being the case, and a competitive price for heating being necessary, it behoves the managements of gas undertakings where gas prices are high for lighting, to consider differential charges (the discount meter comes to the aid here) to encourage what is largely a day consumption of gas. The gas-fire maker and the gas supplier must work to a single end in this matter; and we give the former (we have constantly done so the last few years) full credit for doing their part. We read about, if we do not all experience, the embarrassment of riches; and certainly, in catering for this gas-heating business, the makers, by the numerous good types of fires they present, embarrass the purchaser by the wealth of what they have, by their endeavours each to build up success, to offer. There is one good thing about this. There can be no sacrifice of business to-day through inability to meet the tastes of clients. Many people, many tastes; and with Time's advance, new ideas and new fashions, even in heating appliances. Therefore, the long range of types in external design and in details of construction is not a matter to be decried, though there is in it a certain amount of inconvenience.

For the present season, there are not the marked changes in the construction or in the detail of gas-fires that immediately preceding seasons have witnessed. Externally, there are new designs this year that are of very high merit from the artistic point of view; and some of them aim at ranking (gas-fires have ever been the superiors in the matters of economy and efficiency) equally, from the appearance point of view, with the initially costly electric radiator, while intruding less upon the householder's pocket. But for the most part, the designs of last year (which are moderate in price, and are of an order to meet the requirements of the greater market that there is for gas-fires) are retained this. Internally, the fires have not undergone much change; and it is not easy at present to see how they can until some radical alteration comes along. We can never tell in a business such as this (in which unremitting investigation is being made by the makers to secure novelty and superiority, and through them commercial advantage) when further changes may be effected. In this year's gas-fires, there are noticeable several small internal improvements. Attention has been paid to the fuel, to its fixing, and in one case a combination gas and air adjuster and governor has been produced. The old method of having a boiling-ring at the top of the stove, which does not assist in preserving appearance, is being superseded, to a larger extent this season, by a side-swing boiling-ring, or one at bottom of the fire. There is also quite a novel idea before us in connection with a top boiling-ring.

But greatest of all has been the attention devoted to the question of interchangeability, which means (on account of maintenance) great reduction in stock parts, and a general economy in this regard. The question of constructing gas-fires on modern lines for small fire-places and small rooms has not been overlooked; and to make stoves of dimensions appropriate to their environment has been a matter upon which there has been some expenditure of thought and action, to good effect. Suitable fires to stand in front of an ordinary fire grate with the bars removed, have also been designed. Speaking of this, it is a great pity that, instead of houses being built in these times to take fixed coal-fire grates, the owners do not construct them with in the rooms tiled recesses in which either a coal dog grate or a gas-fire could be put. We can quite understand this would not accord with the views of the coal grate makers; but it would be a common sense proceeding. There is no more reason why a coal grate should be made part and parcel of the fabric of a dwelling-house or other building, than fittings for lighting. Very attractive would be the houses that were built with fire recesses as suggested; the tenant being offered gas-fires or coal or coke grates to set into them just as his fancy dictated. Builders have been shown the attraction of change in the design of their houses; but they have stuck tenaciously to the custom of the fixed grate, while the portable one offers them and their tenants so much more in the way of convenience and choice. Custom is a curious thing. It is a hard master, and a terrible sinner against the times.

However, the present gas-fire season has started well; the gas-fire makers are ready for it; and every gas undertaking that does not enjoy a successful gas-heating season will only have itself to blame. The time is ripe for pushing this business with acute activity and shrewdness.

### The Next Large-Scale Gas Exhibition.

WHEN is the next exhibition on the large scale to be held in connection with the gas industry? Some people are saying that 1913, being the fiftieth anniversary of the foundation of the British Association of Gas Managers, would be an admirable occasion on which to make a striking display. The idea is undoubtedly a good one. The jubilee of our central organization in the gas industry could not be better commemorated than by making a public demonstration of the technical and commercial advances of the industry, as it would serve the double purpose of celebration and public education. By the penultimate month of the year named, nine years will have passed away since the Earl's Court Exhibition; and therefore no one can say, with such a time intervening, that there has been any undue pressure in the matter of holding large collective displays of gas appliances. There have been since then occasional local displays; but they have been mixed up with, or have had part in, multi-featured exhibitions. We are also now hard upon the Smoke Abatement Exhibition in Manchester, where gas promises to make a particularly effective showing; and it is

proposed the exhibition shall be practically reproduced in London next May. But these are altogether different from the large-scale exhibition, which should belong to the gas industry alone, which should be held before long, and which would be very opportune in the year 1913. The electrical industry are doing more than the gas industry now in the way of exhibitions. They seem to have fixed on triennial periods for exhibitions of the large order (quite apart from local displays) as the proper thing; the latest effort being inaugurated at Olympia last Saturday. The previous electrical exhibition was held in Manchester in 1908; and the one before that in London in 1905. Our competitors are quite welcome to exhibitions of greater frequency than the gas industry sees fit to hold. Their necessities no doubt demand them.

However, whether or not a gas exhibition on the large scale is held in 1913 or at some other time, the question is on the wing; and therefore it is not too early, before any promises or formal suggestions are made, to call attention to two or three points connected with organization. The conditions are altogether different to-day from those that existed at the time of the Earl's Court Exhibition in 1904. Then the Society of British Gas Industries did not exist. Now it does; and it is an active and influential body—so influential that there can be no really successful or effective exhibition on the large scale without that body has representation and voice in the matter equally with any other body. Then the next point is that, in the organization of an extensive exhibition, an altogether different process will have to obtain from that associated with the Earl's Court Exhibition. After that event, it was found that there was much discontent over the expense of the show to the exhibitors individually. The system of promotion and organization was not, from the exhibitors' point of view, the best that could be conceived. It was considered that the charges were not so reasonable as would have been the case if there had not been some intermediaries, and had the exhibitors, through a Committee composed of business men of the gas-supply and gas-apparatus sections of the industry, with the assistance of a properly remunerated manager, themselves carried through the whole project. The opinion was very general that, through the system of organization on that occasion, the exhibitors paid (according to their reckoning as men knowing something of these matters) excessively for everything—from space to stand construction and all else; and consequently, for long after, feelings were somewhat ruffled over the matter. This is a mere statement of fact; and views may, of course, vary as to what constitutes excessive payment. However, this feeling must not be aroused again. The experience then, compared with another system of organization since, has satisfied that an exhibition can be run on more moderate cost lines than the Earl's Court show, and yet not depreciate in any respect excellence of character. It cannot be overlooked that professional promoters of exhibitions of a special character—such as one applying to the science and art of gas manufacture, distribution, and utilization—cannot do much of themselves to make an exhibition itself attractive, and yet that is really the main and important part of the work of organization. If the gas industry, as represented by the Institution of Gas Engineers and the Society of British Gas Industries, determines to have an exhibition, the actual organization of the exhibition itself is a comparatively simple matter; and the services of the professional promoter would not be required. But the services of a professional manager, who knows the ropes of exhibition publicity, and the work of carrying through the details of the display, are necessary, as no Committee without an executive official of the kind could attend to all the minutiæ involved.

There is another matter. If a general gas exhibition is promoted in 1913, or at any other time, the question of expense will be one that will have to be most carefully considered. The manufacturers of gas plant and appliances will not, we know, be disposed to again bear the bulk of the cost. And why should they? The cost will have to be a joint obligation on the part of the gas-supply industry and the manufacturers; and that is another reason why the method and conditions of organization will have to be vastly different from those that obtained seven years ago. It does not call for much argument or consideration to see that dual responsibility for the expense involved is the only fair course. The objects of an exhibition of the kind should really be the governing factors in the matter of obligation regarding expenditure. The primary objects of a gas exhibition on the large scale are to educate the public by demonstrating the economic and service-rendering progress of gas, and through that to create new custom for gas, and to induce the adoption of improved gas appliances in the dwellings of existing customers. The gas-supply industry reaps benefit from the increase in the consumption of gas; the makers of appliances, from the profit on the appliances sold as a result (immediate or remote) of the exhibition. The manufacturers of plant at such an exhibition cannot hope for the patronage of the public, but they do find such an exhibition a good opportunity for making an ocular display of the character of their goods to the gas engineers who are drawn together by the show from all parts of the country. It is so easy to see that an exhibition project on a large scale is a matter for joint responsibility in all directions, and not for any unfair imposition on one side. The electrical exhibition opened at Olympia on Saturday is not being run for the purpose of making a profit; but for the benefit of the electrical industry as a whole. Should any profit accrue, it is to be returned to the exhibitors as a rebate on their rentals.

It will not—this, at all events, was settled seven years ago—be the slightest use again attempting to organize a large gas exhibition on Earl's Court terms; and the points raised in this article may as well be thoroughly appreciated in good time, if there is any serious idea of promoting an exhibition in the jubilee year of the Institution.

## Dr. Fleming's Aerial Flights.

We have now before us the full text of the last of the Cantor lectures delivered by Dr. J. A. Fleming, F.R.S., at the Society of Arts, and which lecture dealt, after a fashion, with the subject of cooking and heating by gas and electricity. We do not intend to comment upon all of the many points of the deliverance, though perhaps it deserves something exhaustive, if not caustic. Anyone, however, who reads the composition, will see the obvious criticisms to which, in its every part, it is exposed. The feature of the lecture that strikes us most is that a scientist of the position of Dr. Fleming should have delivered himself of so much that is purely theoretical, hypothetical, and postulatory. The lecture proves nothing of real practical value; but it emphasizes the well-known fact that, in its appliances for heating and cooking, and in the costs involved—initial, maintenance, and running—the electrical industry is still far behind in the race for domestic application, even on the *pseudo* assumptions adopted by the learned Doctor. The Cantor lecturer of this year does not give the gas industry credit for anything but what of an old-fashioned order is established in his mind. He takes in one instance a price for gas—viz., 2s. 9d.—that does not obtain anywhere in London to-day; he gives the gas industry no credit for making advances in its appliances that have considerably added to their practical efficiency; and he does not admit into his calculations any possibility of such a thing happening. The Doctor unconsciously declares himself to the gas industry as being lamentably in arrear in his knowledge of its technical and commercial progress.

Examine his statements in connection with the heating of rooms. He remarks that nothing could be more unscientific than the ordinary system of room warming by gas or coal fires; and, speaking specially of gas-fires, he adds "the "greater part of the heat goes up the chimney with the pro- "ducts of combustion." A little later we see what he means by "the greater part" when he remarks: "Hence 75 per "cent. of the available heat *may* ["may" not "does"] pass "up the chimney with the products of combustion." How is it that Dr. Fleming did not, before delivering these lectures, take the trouble to study the extensive scientific tests that have been made, with the latest types of gas-fires, during the past three years or so, at the Leeds University, under the direction of the distinguished Professors there? Had he done so, he would have saved himself from slipping into such an egregious blunder as the one he was guilty of, and which sadly undermines his argument, as to the "greater part" of the heat from a gas-fire going up the chimney with the products of combustion. He would have found that, with the best of the types of gas-fires on the market to-day, taking the radiant heat, the convected heat, and the measured heat of the products of combustion, the last-named does not exceed 25 per cent. of the total heat generated by the combustion of the gas. Then Dr. Fleming bases his cost calculations on a gas-fire consuming constantly 45 cubic feet of gas per hour, for 56 hours a week, to heat a room of

2500 cubic feet capacity. He admits that it is wrong, but nevertheless he uses the result in his comparison. This consumption of 45 cubic feet per hour indicates a gas-fire that is not of the most efficient type; and it does not suggest one fitted with a duplex tap so that a number of the burners can be extinguished as required without affecting the flame efficiency of the others. Throughout this part of the lecture, there are the plain signs of the absence of modern knowledge and acquaintance with the issues of modern research, in connection with this branch of the work of the gas industry, with the result that Dr. Fleming can only accord to gas a superiority of 2s. in cost—*i.e.*, 7s. for gas, as against 9s. for electricity at 1d. per unit—for heating a room for a week under the conditions mentioned. We are not surprised at this when the circumstances are duly noted.

It is observed, however, that while the lecturer has not (unconsciously it may be) taken the best modern conditions and knowledge regarding gas heating, he applies absolutely the most favourable that his more intimate knowledge will permit him to do for electric heating. We see that "experience shows that a rate of supply of electric energy "equal to 1 watt for every cubic foot of air in a room will "in general [?] maintain it at a comfortable temperature in "winter. Hence, in the case of a room of 2500 cubic feet "capacity, it would require at least 2 kelvins, or 2 kilo-"watts, per hour to be supplied to keep it warm in winter." Now in making his subsequent calculation, why does Dr. Fleming depart from his theoretical standard of 1 watt per cubic foot of air? We ask the question because, taking this figure, we get 2½ units per hour as the energy requirement for heating the room, and a cost of 11s. 8d. a week, instead of 9s., at 1d. per unit. In his figures for gas, he is careful to take the maximum throughout. We are not prepared, however, to agree with the standard of 1 watt per cubic foot of air capacity, as the result of experience in winter for information purposes with a radiator, consuming more than the lecturer's 2 units of electricity per hour, led to its abandonment as an inefficient and uneconomical heater for a room of less than 2500 cubic feet capacity. There is another point in connection with this provision of 1 watt per hour per cubic foot of air. The lecturer stated that, in the room of 2500 cubic feet capacity, it would require at least 2 units per hour to be supplied to it to keep it warm in winter by electric heating; and he added that this is equivalent to a complete renewal of the air every two-and-a-half hours. This is not very explicit. But earlier in his lecture, Dr. Fleming stated that "the air has to be renewed at least twice an hour for "the removal of the carbonic acid and organic products." There is a matter here that requires explanation to show why, with electric heating, he only allows renewal once every two-and-a-half hours, while he admits the necessity for renewal twice every hour for sanitary reasons. We recommend to his careful consideration the Glasgow tests reported in the issue of the "JOURNAL" for Jan. 4 last year.

It is unnecessary to traverse the Cantor lecturer's statements as to the theoretical costs of boiling a pint of water, nor the heating of the absurd allowance of 10 gallons of water for a bath. Dr. Fleming has a wonderful electrical kettle; but even with a 80 per cent. heat efficiency, even, too, if the heat efficiency of a kettle with gas boiling-ring is only 60 per cent., and even further taking gas at 2s. 9d. per 1000 cubic feet, we have a cost, on the lecturer's own showing, between three and four times less for the latter than for the former—being an economy at which the plain man, with a limit to the depth of his pocket, does not choose to sneeze. Dealing, however, with a pint of water, and reducing the cost of so doing to the second place after the decimal point, may be to the liking of an electrical specialist of the standing of Dr. Fleming; but it does not fit the plain, practical, everyday world. Another evidence of the Doctor's inability to drop down to the practical plane is seen in the remarkable suggestion (if we appreciate correctly his meaning) contained in the following sentence: "We may say that in the public supply of hot water for "domestic purposes, there is a source of revenue for electric supply stations which has hardly yet been touched "upon." What does he mean by this? When he says "public supply," does he intend a distributed supply? If ever a distributed supply of hot water can be shown to be an economic proposition, then it will most certainly not be by having electricity as the heating agent.

The Doctor has not much to say about cooking by electricity. Nothing in his view appears to be right in connection with it, though he is more hopeful and confident than we are. However, what he has to say in this connection is altogether commonplace. It has all been said before, and will doubtless often be said again by electricians. Nevertheless there are two or three points that may be extracted as having been endorsed by Dr. Fleming. He states that the advantages of low voltage are supreme in the case of electric cooking; and that "it is nothing short of a crime to "place in the hands of ordinary domestic servants, electric "cooking apparatus worked at 220 volts off one side of a "440-volt service. Then the chief fault of much of the "present electric cooking apparatus is that it does not supply "a sufficiently high temperature, or furnish heat quickly "enough. . . . In cooking, it is necessary to be able "to command high temperatures quickly for a short time." With gas, heat can be obtained promptly; and the range of heat regulation that it places in the hands of the user is just that which should meet all the desires of Dr. Fleming—were he not Pender Professor in Electrical Engineering in the London University. We do not think he has succeeded in doing much towards advancing the cause of electricity for domestic heating purposes; certainly he has not damaged the interests of gas as an agent in this particular direction.

## High-Pressure Gas Schemes for Street Lighting.

THE report of the Commission of the Société Technique du Gaz who have been inquiring into the question of the adoption of high-pressure gas lighting in the capital and other cities of France, Germany, and England is not all that we could have wished it had been in the matters of completeness and time. But notwithstanding its defects, it is of value as indicating how rapidly high-pressure gas lighting is, in many main thoroughfares, displacing low-pressure gas lighting, as well as preventing an extension of, and superseding, electric arc lighting. This is not to be wondered at when consideration is paid to the illuminating power derivable per cubic foot of gas consumed by the employment of high pressures, and the lowness of the cost of the illumination afforded. A point that is very striking about the report is the expenditure that Berlin is, and Paris is contemplating, making annually in securing the best, the most dependable, and the most economical light for their streets. Berlin, we learn from the report before us, is spending about a million marks per year in the extension of the high-pressure gas system; and it is believed that the complete scheme allows for a length of high-pressure gas-main corresponding to a total outlay of 10 million marks. The experimental high-pressure lighting has also so favourably impressed the Municipal Council of Paris, that the Gas Company are to submit a high-pressure scheme for the main thoroughfares of the city. The complete scheme for all Paris will mean an expenditure of somewhere about 15 million francs for lamps, brackets, and service-pipes, but exclusive of the mains and compressing stations.

Is it at all conceivable that these large municipal councils would expend, or contemplate expending, such sums of money, unless they were convinced as to the superiority of the high-pressure form of lighting over all other systems of street illumination? It all shows the direction in which favour has set; and it puts a confirmatory seal upon the view that the time rolls rapidly nearer when the main streets of our principal cities and towns will be equipped from end to end with high-pressure mains not only for lighting but for other purposes. A further lesson of the figures is that Berlin and Paris are not afraid of engaging in large expenditures in order to get the superior illuminant—superior at all times and under all circumstances—for their streets. The London lighting authorities would look very much askance at anyone suggesting for street illumination expenditure on such a magnificent scale. Speaking of London, the Commission do not do it justice in the scant information afforded. Westminster is the only example quoted. Nothing is said of the City as the patron of the early forms of high-pressure lamps, and experimenter with the new; nor is anything said as to the clean sweeps that the high-pressure lamps have made in many parts of London and the suburbs for the outside lighting of shops—the latest information being as to the 111 electric arc lamps displaced in only two roads by the Brentford Gas Company.

One point of technical information appears in the report. It is that an experiment made in Paris with the use of low-pressure gas and compressed air has not proved successful, owing chiefly to the moisture contained in the latter, and the consequent condensation in the pipes.

## Electrical Exhibition at Olympia.

The electrical exhibition was opened on Saturday at Olympia, and will continue until Oct. 21. A visit to it will be of interest to all our readers, if it is only to see how thoroughly well organized it has been, under a Committee and an Exhibition Manager. Any profits that may result will be distributed *pro ratâ* among those who have paid for space. There is also much to be seen in the exhibition; and it will portray to all gas engineers and managers visiting it, the position in the matter of equipment for attack and for defence of the most active of the competitors of the gas industry. In a special article elsewhere, we congratulate the electrical industry upon the general character of the display made; and certain other matters also receive comment.

## Converting $CS_2$ to $H_2S$.

It will be remembered that, at the last meeting of the South Metropolitan Gas Company, the Chairman (Mr. Chas. Carpenter) referred to the partial reversion to the use of lime as a temporary bridge over the difficulty of an excess of sulphur compounds in the gas, until research enabled the Company to apply a less offensive and troublesome method of obtaining relief. He further said they expected to have at work shortly a large-scale plant in which would be embodied some of the latest aspects of the purification question. What the Company are aiming at is the partial conversion of carbon bisulphide to sulphuretted hydrogen by subjecting the former to heat; and that is what the large plant Mr. Carpenter spoke about is intended to test. In this connection, the abstract (published in our columns last week) of the specification of the patent of Mr. E. V. Evans, of the South Metropolitan Company, is peculiarly interesting. The heat method of transforming carbon bisulphide into sulphuretted hydrogen is not new; but there have been high-temperature difficulties. Mr. Evans has, however, found that the temperature to which the contact substance is treated need not be nearly so high as has been previously supposed, if care—this appears to be the important thing—be taken to preheat the gas before it passes over or through the heated contact substance. The mode of gas preheating, the construction of the apparatus, the character of the heated contact material were explained last week (p. 749). The whole arrangement for sending sulphur from the plant in the form of sulphuretted hydrogen appears to be simplicity itself. We are hoping to hear more of the plant when a thorough test on working lines has been made. There are many places where this or the Cheltenham method of removing or reducing the carbon bisulphide from the gas, without the nuisance created by the ordinary lime process, will be useful. But engineers with vertical retorts will say they have no use for any of these new adjuncts to purifying systems.

## The Latest Co-Partnership.

As was to be expected, the employees of the Plymouth and Stonehouse Gas Company accepted, with expressions of gratitude, the co-partnership scheme which the Directors recently offered them. Their meeting last Wednesday stands out like a green island amid an ocean of labour troubles. It focussed and emphasized the good feeling which has so long existed between the Company and their workpeople. For many years past, the Directors have given tangible proofs that they are mindful of the interests of the men; and the men, on their part, appear to have been contented and loyal. The offer of co-partnership was quite a voluntary act of the Board. It supplements such other benefits as the men have hitherto received in the way of pensions and compensation allowances, and is, in fact as well as in word, a real bonus on the men's earnings. As it has been made retrospective for a year, each of the men starts with an allowance of 4 per cent. on his last year's wages, and the certainty of 5 per cent. on the amount earned this year. If, as the result of his co-operation with the Directors and officials, the price of gas is further reduced, the bonus may become 6 per cent. in future years. In its main features the scheme is on identical lines with the successful co-partnerships of other gas companies; and there is no reason why it should not prove in every way as beneficial as they have been. For the present, its application is to be limited to the men engaged in manual labour—the stokers, fitters, &c. But Sir Joseph Bellamy held out the hope that in the not distant future the clerical staff, and the rest of the employees, will also participate in its benefits. So far as it goes, it is costing the Company nearly £1000 a year; but, as Sir Joseph remarked, the money is well laid out if its only return is in good feeling.

## Its Further Extension.

There is, everyone knows, a vast difference between willing and grudging service. Co-partnership tends to bring out the best there is in a man, because it ensures him a direct share of the advantage which may accrue from his extra exertions. It was said by one of the companies' witnesses before the Railway Commission last week that it had not been regarded as practicable to apply the co-partnership principle to the railways. What the difficulties are is not clear. It would, no doubt, involve a considerable amount of work; but in undertakings so highly organized as the railways, this alone would not be an insuperable barrier. Probably if it were attempted, the trades unions would be found a serious obstacle, as they have been to the carrying out of the conciliation and arbitration scheme. The experience of many gas companies, however, goes to show that, in spite of the hostility of trades unions, co-partnership schemes can be worked with benefit all round. An essential factor to success is that the men shall be made to feel that, in participating in the scheme, they are actually benefiting. They cannot be expected to be enthusiastic over co-partnership, or conciliation, or any other remedy for the grievance of a life of toil, if it is accompanied by the suspicion that what is granted with one hand is being taken away by the other. Happily there is no such fear in regard to the Plymouth co-partnership scheme, or any similar project in connection with gas companies.

## Reward for Successful Candidates.

The Council of the Society of British Gas Industries are showing a very live interest in the internal affairs of the gas industry. The members are concerned equally in the progress of the gas-supply industry with the company and municipal owners of the gas undertakings. The degree of progress of the latter sets the limits to the progress of the manufacturers of plant and appliances; and thus their interest in all that appertains to the common welfare of the industry. In several ways the Society have given material expression to their willingness to work co-operatively with the gas-supply section of the industry. The part they took in the founding of the Livesey Chair of Gas Engineering and Fuel at the Leeds University is remembered; there is also the interest that is being evinced in the question of publicity; and in many other ways there has been co-operation of a valuable order. Now we learn from the Secretary of the Society (Mr. Arthur L. Griffith) that the Council have decided to give ten guineas annually in prizes on the results of the City and Guilds of London examinations in Gas Supply and Gas Engineering (Honours Grade). The amount will be equally divided between gas engineering and gas supply; in each division three guineas being the first prize, two guineas the second. This encouragement on the part of the Council of the Society to the juniors of the gas industry who submit themselves to examination will be much appreciated. It is a practical way of patting a young man on the back for success in real endeavour. This brings to mind the suggestion that Mr. T. B. Peattie made during the discussion on the paper that Mr. F. J. West read at the November meeting last year, on enlarging the scope of usefulness of the Society; and possibly the present announcement is the outcome of that proposal.

## Tar Surfacing of Roads.

Kent has done more than any other county in the country in proving the efficiency of the use of tar under the modern conditions of road use for preventing dust nuisance and for maintaining the roads; and Mr. H. P. Maybury, M.Inst.C.E., the County Surveyor, has been the best of advocates, and what he has preached he has practised. The doctrines and practices of the road surveyor and engineer have been forced by current circumstances to undergo considerable revision; and "current circumstances" in this special department have found few, if any, more pliable and receptive technical natures than Mr. Maybury's. As soon as ever the old methods displayed their defects under the new conditions, he accepted the position of the need of new treatment. Thus it comes about that year by year Kent has been spending, by the thousands of pounds, money in improving their main roads by the aid of tar and pitch. Last year, as Mr. Maybury's annual report shows, the tar bill for Kentish main roads alone came to £20,594; 823,766 gallons of tar were used; and 371 miles of surface were dealt with, or nearly 5 million superficial yards. Calculation shows that the £20,594 is the over-all cost of

the tar treatment—seeing that it is equal to 6d. per gallon of tar used. The sum, however, only represents about 1d. per superficial yard treated, which, as an average for the various kinds of work done, is remarkably low. Apart from tar treatment, road maintenance charges decreased by £11·8 per mile, compared with the previous year. Maintenance costs have been receding ever since tar came into use on the roads; and we know Mr. Maybury would attribute no small part of the saving to its employment. In fact, he says in one part of his report that the roads, in consequence of this treatment, have been much improved in strength; and the dust nuisance is little more than a memory now where the work has been done. The total expenditure of the Council, however, on tar painting and cognate work during the year was £25,708. In the urban retaining districts £4855 was paid to the several authorities for painting about 120 miles of road, representing 1,344,380 superficial yards. There was also spent a sum of £258 upon bituminous binding preparation, having asphalte as its basis. Speaking generally, by the treatment, the roads of Kent have been much improved in strength. But the simpler applications of tar are not suitable for all locations. Where traction engines and commercial motor traffic is greatest, it will have to give way to granite macadam and pitch matrix.

## An Industrial Board.

Another project which may have important issues—whether permanent is a matter upon which the results of certain other schemes would make one speak with reserve—has been put forward with the view of contributing to industrial peace. While we were contemplating the mischief that had been wrought by the dockers', carters', and railway men's strikes, the scheme from which great things are now expected was introduced to public notice. It emanated from the cotton industry; and Sir Charles Macara, of the Cotton Masters' Federation, appears to have been the author, or, at all events, he was the advocate. The plan, which proposes an Industrial Board, has yet to be put into practical shape. But meantime it has commended itself to the Government; and it is stated that the Board of Trade have sent out invitations to the leading representatives of masters and men in the great national trades to form an Industrial Board. The new authority, it is said, will have as its Chairman Sir George Askwith, K.C. The period of office suggested for the Board is twelve months; and the constitution of the Board, ten leading employers and ten labour representatives. The Board of Trade, while not contradicting this statement as to what is on the *tapis*, say it is unauthorized and premature. We shall see as to how far it is premature when an official announcement is made.

## A Word of Warning.

There is time yet, before the holding of the Miners' Federation Congress, for due consideration to be given to some weighty words from the pen of Mr. D. A. Thomas, who deals, from the coalowners' point of view, with the questions of the payment of miners for working in abnormal places and the fixing of a minimum wage. The demand for a minimum payment of 8s. a day to good, bad, and indifferent workmen alike is one which, if conceded, would, in his opinion, render impossible the working of a South Wales colliery at a profit. If this expression of opinion from one who is in the best position to judge of the matter is not sufficient for the members, they can satisfy themselves by acceding to an appeal to give the experiment a trial with the funds of the Federation. They are, it may be imagined, not likely to do this; and therefore perhaps Mr. Brace, M.P. (to whom Mr. Thomas's remarks are addressed), will take heed of a warning that it will require all the tact, patience, and effort of moderate men on both sides, "if we are not to be landed in the gravest labour struggle this country has perhaps ever witnessed—a struggle the consequences of which no man can altogether foresee." It is admitted the men have legitimate grounds for dissatisfaction with the present method of fixing the payment to be made for work in abnormal places; but this, of course, is a very different thing from assenting to the proposition that all men, whether good workers or not, should be in receipt of a fixed minimum wage. Many underground men of certain classes are already on a daily wage; but Mr. Thomas has learnt from costly experience that he cannot secure a reasonable day's work from a collier underground unless his wages depend upon the quantity of work done. He says, however ready the majority of Welsh colliers are to honestly put forward their best efforts under any condition of payment, they may not be permitted to do so by the lazy or dishonest men working alongside. In brief, though there is a legitimate grievance requiring to be removed, the argument for the coalowners is the extremely simple one that it is not advisable to ask for a remedy which would remove the stimulus now provided under the system of piece-work.

## The Question of Income-Tax.

Dealing with the question of income-tax in a contribution which he termed "A Plea for Fair Play for Commercial Interests," Mr. M. J. Stapleton, at a conference of the Society of Incorporated Accountants and Auditors, made a number of recommendations, which he pointed out were substantially in accord with those embodied in the report of the London Chamber of Commerce. The first of these was that the production of balance-sheets should not be insisted upon by surveyors of taxes, and that taxpayers who object to produce such balance-sheets should not be refused the statutory allowance for depreciation or be placed under other disadvantages, provided that the ordinary profit and loss account had been certified by a professional accountant. He urged that depreciation should be allowed on buildings, furniture, fixtures, and fittings; and that the following items appearing in the profit and loss account should be allowed as charges against profits for income-tax purposes: Gifts or gratuities in the nature of payments for services rendered; accidental losses not covered by insurance; cost of removal of business from one place to another; and preliminary expenses of joint-stock companies. Another point he made was that the rates of depreciation on plant and machinery should not be left to the discretion of the surveyor of taxes, but that, if fixed scales for particular trades are deemed impracticable, the allowance agreed by the accountant who audits the accounts should be accepted. He also thought that accounts certified by professional accountants should be accepted by surveyors as correct in detail, but that it should be open to surveyors to raise questions of principle. There were other recommendations; but members in the subsequent discussion largely turned their attention to the question of the principle of furnishing balance-sheets to the surveyors of taxes. Several of the speakers appeared to be in accord with one who said he was not at all sure it was wise to oppose in principle the furnishing of balance-sheets, as their object was to get a fair and reasonable assessment, and the more information they gave the more likely it was that they would secure such an assessment.

## Annual Meeting of the Michigan Gas Association.

The twentieth annual meeting of this Association was fixed to be held in Detroit (Mich.) on Wednesday, Thursday, and Friday last, under the presidency of Mr. A. P. Ewing, of that city. The papers on the programme, for reading and discussion, were:

"The Function of Tar in the Condensation of Coal Gas," by Professor Alfred H. White and the Holder of the Scholarship.
"Advertising: A Brief," prepared by C. A. Brownell.
"Experiments in the Taylor System of Shop Practice," by Ben. M. Ferguson.
"A Purchasing System for a Gas Company," by Albert G. Schroeder.
"Use of Reinforced Concrete in Gas-Works," by H. W. Douglas.
"A Concrete and Wood Condenser-House," by E. F. Lloyd.
"Filament Ignition of Gas," by Professor Howard Lyon.
"Development of Hotel and Restaurant Gas Appliances Business," by W. F. Clausen.
"Directions for the Recovery, Concentration, and Testing of Ammonia," by James A. Brown.

**The late Mr. Robert Morton.**—In the obituary notice of the late Mr. Robert Morton which appeared in the "JOURNAL" last week, it might have been mentioned that the deceased left a widow, two daughters (one married), and one son—Mr. Philip Morton, who is Manager of the Genoa works of the Continental Union Gas Company, Limited. Before obtaining this position, he was with Mr. Fletcher W. Stevenson at Coventry, and previously at the East Greenwich works of the South Metropolitan Gas Company.

**Glover-West Vertical Retorts for Belfast.**—At their meeting last Friday, the Belfast Gas Committee had before them the minutes of a Sub-Committee with reference to the introduction of a vertical retort installation. On the recommendation of the Sub-Committee and the Gas Manager (Mr. J. D. Smith), it was decided to introduce the Glover-West continuous system of vertical retorts, and to accept the tender of West's Gas Improvement Company, Limited, of Manchester, for an installation capable of producing 2½ million cubic feet of gas per 24 hours. In his last annual report to the Gas Committee, Mr. Smith recommended the erection of vertical retorts of this capacity, and that a number of members of the Committee should be appointed to visit several gas-works in England and Scotland where vertical retort installations were to be seen.

## GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 827.)

Last week was an extremely anxious period on the Stock Exchange, and at one time things looked almost as threatening as they well could be. The prolonged tension of international relations was becoming almost too much for markets, both Home and Continental; and apprehension was aggravated by popular disturbances on the Continent setting people thinking of 1848. But, happily, after some three days of alarm, the clouds grew lighter, and the week closed fairly calm. The opening day was not bad. Views regarding the Moroccan outlook and our labour troubles were easier; but Consols had no heart in them. Tuesday was, however, a day of much depression. The new factor of Spanish commotion, and the hardening of money, put everything down. Consols fell $\frac{5}{16}$, Rails were heavy and dull, Americans lower, and the Foreign Market was moved by the death of M. Stolypin. Wednesday was worse. Conflicting statements in regard to Morocco from high authorities, and conflicting interpretations even of these, were bewildering. Everything gilt-edged was flat. Consols sunk below all previous depths by marking 76⅜; and all the chief departments were affected. On Thursday, the worst of the clouds were past; but business was shy and cautious. Consols were a fraction better; and Rails had some brighter points. On Friday, the chief factor was the momentous Canadian elections. More hopeful views were taken of Morocco, Spain, and our own Railway unrest. Confidence revived. Government issues were strong. Consols rose $\frac{3}{16}$, Rails made good progress, and the Foreign Market was strong. The same favouring influences were in operation on Saturday; and markets in general rose. Consols closed 77-77⅛. The Money Market was well supplied. A remarkable incident was a rise in the Bank rate of most of the European States. The Bank of England advanced to 4 per cent. Business in the Gas Market was not abundant. But prices were firm—impervious to the assaults that beat down the more susceptible markets, and affording one more illustration of the merits of gas as a steady-going investment. In Gaslight and Coke issues, the ordinary was quiet and unchanged, with transactions ranging from 106⅛ to 106⅞. In the secured issues, the maximum realized 84⅜ and 84¾, the preference 102¼, and the debenture 81. South Metropolitan was more dealt in; and transactions were within the close limits of 116½ and 117¼. The debenture made 79½. In Commercials, the 4 per cent. made 111½, the 3½ per cent. 106, and the debenture 76. Among the Suburban and Provincial group, Brentford old marked from 258 to 260, ditto new 199 and 202, ditto debenture 98¼, Tottenham "B" 114½ to 116½ (a rise of 1), ditto debenture 96½ free, Liverpool "B" 163½ and 164¼, and Sheffield "A" 238—a rise of 2. In the Continental companies, Imperial marked from 181½ to 183, Union preference 136¼ and 136¾, and European 18⅞ and 19⅛. Among the undertakings of the remoter world, Cape Town was done at 2, ditto preference at 4, Primitiva at 7⅜ and 7 3/32, ditto preference at 5 1/16 to 5 11/32, ditto debenture at 98¼, San Paulo at 21¾, and ditto debenture at 50¼ and 50¾.

## ELECTRICITY SUPPLY MEMORANDA.

### Installing Electrical Cooking Appliances—Wise Words as to Cheap and Nasty Appliances—Thermal Storage for Cooking and Heating—A Mansion Owner's Smouldering Wood Panelling—Four Years after Installation—Eccentricities of Metallic Lamps.

If one carefully reads contemporary electrical literature on the subject of electrical cooking, considerable confusion is apt to arise in one's mind, if there is not other knowledge to guide as to the exact facts of the case. We are told, on the one hand, that initial and installation costs, running costs, and so on are all in favour of electrical cooking compared with gas cooking. But though these things are said, and said by some of the most respectable-looking of electricians, there is no reason to adopt them as coming within the bounds of veracity. We have before us various articles published simultaneously only a few days since by some electrical contemporaries. There is one by Mr. Donald Smeaton Munro on wireless connectors for cookers, in which he offers a plan to manufacturers for getting rid of "some"—"some" does not mean all—"of the chief drawbacks to electric cooking." His proposal is one that will add considerably to installation costs; and we gather that his opinion is that, unless something of the kind is done, electric cooking will suffer. We all know that flexible electric connections are a perpetual source of trouble with any form of heating appliance. When flexibles are used for cooking, the insulation is soon destroyed by the heat, grease, and water; and without these destructive agencies, the very moving about of cooking utensils, soon causes the flexible to succumb to the treatment received. Mr. Munro points out that, if the flexible does not contain an earth wire or is not armoured, the risk of accident is "very considerable," and a shock or flash may mean the abandonment of the whole electrical kitchen. When leaking utensils connected by flexible are kept on an earthed metal surface, they are comparatively safe; but when they are lifted up, and the cook is making-contact with a metal surface or stone floor, then there is likely to be trouble. Bridget would be set dancing, and something for dinner would be spoilt. Putting together all considerations, Mr. Munro is of opinion that it is vital to the general adoption of electricity that flexible cords should be got rid of altogether. They are eliminated if ordinary utensils are set on an electrically-heated hot-plate; but such a method of heating is very wasteful. Now there is Mr. Munro's plan of wireless connection. It is not difficult to understand. Single heaters with two plugs, or triple heaters with three plugs, may be used; the heaters being fitted with standardized parallel prongs for making electrical connection. A metal or wood table or shelf may be employed, so long as the surface is faced with metal, usually zinc, and the surface earthed. On to the top of the table are screwed two lengths of grooved and polished slate, with tube-contacts fixed at intervals across the seam between the two slabs of slate. The grooves in the slate are for the purpose of carrying the wiring. We will not go into details; but such a system being imperative according to Mr. Munro to avoid accidents, and to prevent the cook being frightened nearly out of her life by electric shock, it will be observed that here we have the design for a very expensive form of installation, which will hardly fit any pocket other than that of the wealthy.

Then simultaneously we have an article in the "Electrical Times" dealing with the initial cost of appliances, which some electricians say will now compare with gas-cooking appliances? Where costs compare, what about durability? The writer of "Installation Topics" in our contemporary (which contemporary once published and wasted a lot of labour, paper, and office and printers' ink on a domestic electrification number) issues a warning against the cheap class of electrical goods. His views are strongly worded. We are almost inclined to publish them *in extenso;* but as there are other topics to be referred to, we must content ourselves with epitomizing them, while preserving our own views as to such rash remarks as "results which cannot be equalled by gas or coal." We will forgive him such breakings away from wisdom as a sort of exchange for the remainder of his monitory remarks. He submits that "it is far better to adhere to high prices and supply a thoroughly trustworthy article than to put forward a cheap device which may break down at any moment." It would be better, he asserts, for the electrical industry at large if the development of electric cooking were deferred for another generation rather than to meet the present demand for cheapness by placing in the hands of users low-priced utensils, which cannot give lasting satisfaction. "There is now no difficulty in obtaining individual electric heating utensils or complete cooking ranges which will stand the racket of continuous wear and tear in the kitchen. They will give, permanently, results which cannot be equalled by gas or coal; but although running costs are by no means excessive, the initial outlay is heavy. A contractor may be able to sell ten electric kettles at 7s. 6d. apiece, for each one he could dispose of at double or treble the price; but the chances are that he will make ten enemies for life in place of a gratified customer. To offer a complete electric oven at 40s., again, is merely to ask for trouble; and a single dissatisfied user may do a great deal to hinder the progress of electric cooking." He adds that no permanent good can be gained by rushing through cheap and untried designs for the sake of working-up an immediate business; and for the present, makers must be content to exploit the large field existing among those in a position to buy outright. To induce consumers to buy cookers by offering them rubbish at low prices, is to sow the seeds of early discontent and prejudice, which will take a lot to overcome. This is a common experience. But we see from it that, to the substantial cost of installation—in order to, as far as possible, ensure safety, and to preserve the nerves of the cook or lady of the household—must be added heavy initial costs for the cooking appliances, as otherwise they can only mean rubbish, and the rubbish early discontent.

So costs are piling up. We turn to the "Electrical Engineer," and find that some further expense in equipment is needed if the running costs are to compete with those for the like work when done by gas. In the contemporary mentioned—the issue being the same date as the paper referred to in the opening paragraph—there appears an article, with the startling heading "New Principle of Thermal Storage: Remarkable Invention by Mr. C. Orme Bastian." The worthy Bastian's accomplishments, examined through a magnifying-glass by our contemporary, are to work marvels for the electrical industry. In the opening lines of the article before us, we learn there are complex problems involved in the economical utilization of electrical energy for the purposes of heating and cooking; and one fact that had to be faced was that, "in point of cost, electricity was not yet able to compete with gas in the household." There is truth as to the complex problems and the cost. But Mr. Bastian is credited with having solved the problem as to cost. He is the inventor of what is known as the "Quartzalite" system of heating, which is airily said to constitute a vital step in the evolution of the economic cooker and heater; and "with an efficiency closely approximating 100 per cent., this must long remain an important factor in relation to the domestic applications of electricity. But he has made another "long stride" in devising an entirely new system of thermal storage. The ideal aimed at was a device which would render possible the accumulation of electrical heat up to two maxima—one for heating and one for cooking. The first named end is said to be secured by a method under which the current "leaks in," as it were to a "hot box" during the slack period; and thus gradually piles up heat, which can be utilized as and when desired, and for various purposes—the

purpose itself being more particularly regulated by the size of the thermal storage chamber.

In the new device here referred to, the "Quartzalite" glowers are used as the medium for the conversion of the current into "real red heat," as in the Bastian cookers and heaters; but the secret of the new device lies in the method adopted for retaining, and, so to speak, "piling-up" the heat until it reaches any desired maximum, while at the same time the device is so ingenious as to give enormous latitude with regard to the size of the chamber. After the gradual charging process has been in progress during the night or for any specified period, the individual units can be transported to any part of the consumer's house where they may be needed to be utilized either for heating or cooking. Another important feature is that so long as the "hot box" is kept closed, there is practically no loss of heat; but immediately the sliding doors at the top and bottom are opened, a current of air passes through, and the heat is either distributed in a room, or else concentrated in an oven for cooking purposes. In short, what the thermos flask has done for hot liquids, the Bastian "hot box" will it is said, accomplish for actual heat. This is briefly the idea; but how it is going to reduce costs to the electricity consumer, and how there is to be storage, and utilization from storage, without some loss, are matters that must be proved by time and experience. The fact remains that the thermal value of 6 cubic feet of coal gas is equal to that of a whole unit of electricity. Mr. Bastian cannot make the latter of greater thermal value. However, here we have three electrical papers in one week showing in different ways how costs must be piled upon the user of electricity for cooking and heating, in order to endeavour to obtain satisfaction.

Last week reference was made to the annoyance of electricians over the proposal of a Committee of the London County Council to make it obligatory on London hotel and lodging-house keepers where electricity is employed to have the wires encased in metal tubing instead of being boxed in by wood. Bearing upon this matter, and the comments in the "Memoranda" a week since, we have a distinctly interesting report in the "Yorkshire Post" of the 16th inst. The narrative is worth reproducing:

> A fire which might have had serious consequences was narrowly averted on Thursday night [Aug. 14] at Sutton Hall, near Thirsk, the residence of Mr. J. H. Edwards. The family had dined earlier in the evening than usual; and about half-an-hour after they had left the dining-room, Mr. Edwards sent his little daughter back to the room for something. When she placed her hand on the electric light switch inside the room, she was surprised to find that the button burnt her finger. She at once informed her father; and the butler was sent to see the cause. The room is panelled in wood; and on examination the panelling near to the switch button was found to be hot and charred almost the whole distance from the floor to the ceiling. The wires, which run between the panelling and the stone wall, had apparently fused; and although no flames could be seen, the wood was smouldering for some distance. Owing to the great age and dryness of the panelling, the fire would no doubt have spread rapidly if it had not been discovered; and the house and its valuable contents might have been destroyed.

In a conversation with the Thirsk correspondent of our contemporary, Mr. Edwards said he thought the incident was deserving of the very close attention of insurance companies, as well as of the owners of old country residences, to say nothing of public institutions and the ordinary householder. The electric installation in this case had been running for four years, had never hitherto given any trouble, and had been considered pertectly safe; and in these circumstances it becomes a question of how many buildings installed with electric light may be considered safe. Mr. Edwards suggested the desirability of a public inquiry on the general subject of the precautions possible against the fusing of electric wires in buildings. The statement as to the lapse of four years before this trouble occurred, further illustrates our comments of last week. It was an ugly experience for Mr. Edwards and his family; and his confidence in the safety of electric wiring has received a rude shock.

A correspondent of the "Electrical Times," signing himself "Lucerna," has been studying the eccentricities of metallic filament lamps. In a recent letter he calls attention to one peculiarity that he has observed, and promises to mention others if someone can give him a plausible explanation of this one. His letter may be quoted:

> A few months ago I arranged a 100-volt 25-candle power lamp (A) and a 50-volt 16-candle power lamp (B) in a two-holder bedroom fitting. One lamp was tantalum, the other tungsten; but both metals are doing excellently under normal conditions in the same house. The alternating current pressure was 50 volts. "B" was used for ordinary purposes; "A" and "B" were switched into series as a night-light. Lamp "A" was nearly, but not quite, new when it started. After about one month's use at this fractional voltage, it gave out. I assumed this to be accidental, and replaced it with another lamp of exactly the same kind and rating. After five or six weeks, this also yielded up the ghost. Meanwhile lamp "B," though nightly subjected to its full working pressure, continues in good health. Is there any reason why metal filaments of any known type should deteriorate rapidly on such a reduced pressure? I should have thought such a condition would ensure them a ten years' life.

The Editor of the "Electrical Times" does not offer a "plausible explanation" of the phenomenon, "Lucerna" cannot do so himself, nor are we prepared to assist him. But the point is worth investigation.

## MR. J. H. BROWN, OF NOTTINGHAM, RESIGNS.

It may possibly come as a surprise to many of our readers to learn that Mr. J. H. Brown, the Gas Engineer to the Nottingham Corporation, has sent in his resignation to the Gas Committee; and he will leave their service at Christmas, if not before. The immediate cause of this step, we believe, was the refusal of the City Council to confirm a resolution unanimously passed by the Committee to increase Mr. Brown's salary by £200 per annum, in accordance with a promise made under the following circumstances: When the filling-up of the vacancy at Birmingham was under consideration, Mr. Brown was invited to appear before the Sub-Committee who had the matter in hand. Thereupon the Nottingham Gas Committee (through the Mayor) offered him an advance in his salary of the amount already named if he would agree to remain in Nottingham for at least three years more. He accepted the offer, which was unanimously endorsed by the Committee; and their resolution was placed upon the *agenda* of the Council. Its consideration had to be postponed, however, in consequence of a resolution the Council had passed deferring all advances in salaries to officials in receipt of more than £150 per annum until a Special Committee had investigated and had reported upon the possibility of paying all the employees of the Council over 21 years of age a minimum wage of 6d. per hour. The Gas Committee's resolution was held over until this autumn; and when it was again presented, with the support of the entire Committee, it was defeated, together with several other recommendations in regard to salaries. Mr. Brown will consequently leave Nottingham, and take the position of Managing-Director of Messrs. Joseph Brown and Co., Limited, Chemical Manufacturers, of Dewsbury, rendered vacant by the death of his father in May last, as the result of an illness which, it may be remembered, prevented the son attending, as President, the spring meeting of the Midland Association of Gas Managers.

The step Mr. Brown has taken will remove from the front ranks of the gas profession a member who, though young, has figured conspicuously in it. In early life he was Chemist in the firm of which he will now be Managing-Director; and his first appointment in connection with gas engineering was as assistant to Mr. Charles Armitage at Lancaster. Early in 1898, he obtained a position with the Ilford Gas Company, where he took in hand the remodelling of the distributing system. The following year, the Directors instructed him to prepare a complete scheme for the development of the whole of the land they had recently purchased for the extension of the works; and it met with the approval of Mr. Corbet Woodall, who said it reflected great credit upon the designer. The works were proceeded with; and a water-gas plant was subsequently erected. This varied experience specially qualified Mr. Brown for the position of Gas Engineer to the Nottingham Corporation, rendered vacant by the death of Mr. W. R. Chester; and soon after his appointment he presented reports on the condition of the works, which were also inspected and reported upon by the late Sir George Livesey. It is unnecessary to refer here to the discussions to which they gave rise. Suffice it to say, that Mr. Brown did not have a very comfortable time during their progress. He, however, has worked well for the gas undertaking; and he had the satisfaction a short time ago of submitting his report for the year 1910-11, which showed record carbonizing and selling results. While busily engaged in conducting the gas-works, he found time to carry out the elaborate series of experiments with low-grade mixed gases of which the results were embodied in the paper he read before the Institution of Gas Engineers in 1905, and for which he was awarded the London Gold Medal. Although his life-work in the future will not be devoted to the gas industry, he hopes to render good service to it in the capacity of consultant.

Referring to Mr. Brown's resignation, our local correspondent, writing last Saturday, said: "One of the principal provincial appointments in the gas engineering profession will shortly become vacant through the resignation of Mr. James Herbert Brown, Engineer and General Manager of the Nottingham Corporation undertaking, who at a meeting of the Committee held this week tendered his notice, which was accepted, and will take effect at the end of the present year. Mr. Brown will then have held the office for nine years, having entered upon his duties in January, 1903. The announcement of the approaching severance of his association with a Corporation, some former members of which did not at one period of his engagement appear to treat him with the strictest impartiality, has given rise locally to the rumour of there being another 'rift within the lute.' But the information is forthcoming that the resignation proceeds from Mr. Brown's desire to be free to undertake the managerial control of the extensive business established by his father, who died in May—that of Messrs. John Brown and Co., chemical manufacturers, of Dewsbury. The position vacated, though not representing one of the largest prizes in the profession, has attached to it an emolument of fairly substantial proportion. While Mr. Brown's tenure of office has not been free from controversy which at one period occasioned in Nottingham unnecessarily heated feeling, the incidents were mainly the outcome of judgments pronounced by self-constituted critics, who possessed no qualification to judge of technical detail. Results have adequately warranted the methods for which the retiring Engineer has been responsible; and for alleviation of heavy local burdens Nottingham ratepayers owe much to Mr. Brown's wise administration."

## PERSONAL.

Mr. W. RAPLEY, late of Gillingham (Dorset), has been appointed Manager to the Hawkhurst Gas Company, for which position (it was advertised in the "JOURNAL" for the 5th inst.) there were a large number of applicants. He will commence his duties on the 7th of October.

From a long list of applicants, in response to the invitation which appeared in the "JOURNAL" a fortnight ago, for the position of Manager and Secretary to the Longridge Gas Company, the Directors have appointed Mr. JAMES LEE, at present Manager and Secretary of the Mullingar Gas Company. Mr. Lee was formerly at Carnforth.

## OBITUARY.

Alderman JOSEPH COLLINSON, whose death, at the age of 65, was recently announced, entered the Halifax Town Council in 1891, and did a great deal of work in connection with the Gas Committee, of which he became Vice-Chairman in 1903, and Chairman in 1905. For several years he had a seat on the Council of the local Chamber of Commerce.

The death is announced as having taken place on the 16th inst., at Pudsey, of Mr. JOSEPH GAUNT, of Rodley. The deceased was a Director of the Harrogate Gas Company, and at the interment last Tuesday, at Pudsey Cemetery, the Company were represented by three of his colleagues on the Board—Messrs. S. Spencer, H. Beaumont, and J. W. Knowles. The absence from town of the Chairman of the Company (Mr. F. Barber) and some pressing engagements of the General Manager (Mr. H. Wilkinson) prevented their attendance.

### Examination Prizes.

The Council of the Society of British Gas Industries have (we are informed by the Secretary, Mr. Arthur L. Griffith) decided to give £10 10s. in prizes annually on the results of the City and Guilds of London Institute's Examinations in Gas Supply and Gas Engineering (Honours Grade). The prizes will be awarded as follows: Gas Supply, Honours Grade: First Prize, Three guineas; Second Prize, Two guineas. Gas Engineering, Honours Grade: First Prize, Three guineas; Second Prize, Two guineas.

### The Gas Publicity Campaign in Germany.

The German central organization for promoting the sale of gas reports that in the past winter 180 lectures on the use of gas were given by three ladies under its auspices. The lectures were undertaken—as to 78 for municipal gas-works, as to 78 for gas-works owned by companies, as to 11 for associations and exhibitions, and as to the remaining 13 for places which are not yet supplied with gas, but in which a supply is desired. The towns where the lectures have been given are fairly uniformly distributed over the German Empire, except that the Grand Duchy of Baden has so far been neglected. Having regard to the relatively small number of gas-works in Germany owned by private companies, it is pointed out, as evidence of the greater activity of private companies in promoting business, that as many lectures have been given on their behalf as on behalf of corporation gas works.

### London and Southern Junior Association Programme.

The first item on the programme of the London and Southern District Junior Gas Association (of which Mr. J. G. Clark is President) for the forthcoming session is a social gathering at the Festival of Empire Exhibition at the Crystal Palace next Saturday. The members and lady friends have been invited by the Directors of the South Suburban Gas Company to take tea in the Garden Club; and the party will assemble near the large clock at the south end of the Palace at 3.45. Subsequent items on the programme are as follows: Oct. 27, an address by Mr. A. F. Browne, followed by an address by the President. Nov. 11, visit to the Old Kent Road Station of the South Metropolitan Gas Company. Nov. 24, a paper by Mr. E. G. Stewart, on "Carbonizing, with Special Reference to High Makes." Dec. 2, a visit to the works of the Gas-Meter Company. Dec. 15, a paper by Mr. S. A. Carpenter, on "Hot Water." Jan. 13, an afternoon visit to the Westminster compressing station of the Gaslight and Coke Company; and an evening visit to the printing works of the United Newspapers, Limited. Jan. 26, a paper by Mr. F. A. Frost, on "Efficient Condensation and its Advantage." Feb. 10, a visit to the Kensal Green Station of the Gaslight and Coke Company. Feb. 23, an address by Mr. W. R. Herring, on "Constructional Details," to be illustrated by lantern slides. March 2, the annual dinner. March 16, a visit to the works of the James Keith and Blackman Company, Limited. March 29, a paper by Mr. F. Caudwell, on the "Uses of Gas for Domestic and Industrial Purposes." April 13, a visit to the works of the Mitcham and Wimbledon Gas Company. April 26, a paper by Mr. N. B. Hodgkin, on the "Distribution Department." May 11, summer meeting at Margate, and a visit to the works of the Isle of Thanet Gas Company. May 24, the annual general business meeting.

## THE LAW RELATING TO GAS AND WATER, BY MICHAEL AND WILL.*

**[Reviewed by A. M. Paddon, Esq., Barrister-at-Law.]**

EVERY branch of industry of sufficient importance is provided with its standard legal text-book; but it is rather more than doubtful if any such section is so well served as that of gas and water by the work in case.

In its inception, the duty of compiling this text-book was most fortunately committed to Counsel of the standing and capacity of William Henry Michael and J. Shiress Will. Through the successive editions issued from time to time, it has never fallen away from its high initial standard of excellence; and the sixth edition markedly supports this sustained quality.

With something like 1300 pages of closely-printed matter—the closer consideration of which will convince the reader that nothing contained therein could be dispensed with without disadvantage—anything more than a general survey is impossible.

The general introduction in itself, with gas and water legislation categorically and chronologically arranged, is of the greatest practical value. Any company official having the acquisition of further parliamentary powers in contemplation, and having satisfied himself as to his objectives, can by reference to these schedules immediately apprise himself of the attitude of Parliament in regard to what he desires. With the "Model Bill" added for the purpose of reference, his work should be comparatively easy up to the point at which it is necessary to hand it over to the Parliamentary Agents.

The arrangement of the Incorporated Acts peculiar to gas and water is excellent; and the cases appended to each important section are clearly and concisely stated up to the latest practicable dates. The Act of 1847 can always be re-read usefully, affording as it does, in the writer's humble judgment, an example of the superiority of the older and more carefully considered legislation, as against modern and more hurried enactments. Clauses 6 to 12 are so vital to the interests of gas companies, and constitute such a complete answer in themselves to any attacks on the powers they convey, that they can always be studied and restudied with advantage. Nine out of ten managers would say that they are conversant with the provisions of these sections; but not one in a hundred could support close examination as to their details. The Metropolitan Gas Acts, which, as has often been pointed out before Parliamentary Committees, are the basis of provincial legislation, are here dealt with separately and clearly. Finally, we have the Incorporated Acts of a general character—such as the Companies Clauses Consolidation Act of 1845—thus making the work absolutely compendious.

In essaying a production of this kind, laymen, however conscientious their work may be, generally fail to grasp the absolute necessity, in these days of legislation by reference, of including General Acts together with special ones; and many works are rendered nearly useless by this omission.

It may justly be said of this new edition that almost every legal problem likely to arise in practice can be completely and exhaustively inquired into between the front and back of this most excellent book. And last, but not least, that uncommon thing, a good index, is provided.

The editor of this edition is to be sincerely congratulated upon the successful way in which he has discharged the office of his distinguished predecessors.

* "Michael and Will on the Law Relating to Gas and Water." Sixth Edition. By Joshua Scholefield, Esq., of the Middle Temple and North-Eastern Circuit, Barrister-at-Law. London: Butterworth and Co., Bell Yard, Temple Bar; 1911. [Price 42s.]

## STATISTICS OF DUTCH GAS-WORKS.*

WE have received a copy of the volume of statistics of the working results of gas-works in Holland for the year 1909, which has been prepared by Heer P. Bolsius, the Manager of Bois-le-Duc Gas-Works, Heer M. van der Horst of the Amsterdam Gas-Works, and Heer G. A. Brender à Brandis of The Hague Gas-Works. The volume follows the same lines as previous annual statistics; but this year Heeren Bolsius and Van der Horst, who have been solely responsible for previous volumes, have had the assistance of Heer Brender à Brandis in compiling it.

The particulars contained in the present issue relate to 138 gas undertakings, as compared with 129 and 121 in the statistics for 1908 and 1907. [See "JOURNAL," Vol. CX., p. 366.] The rapid growth in the comprehensiveness of the volumes of statistics is gratifying evidence of the appreciation of the authorities of Dutch gas-works of their utility and value. Only a few quite unimportant undertakings have not contributed the desired information

* "Statistiek Overzicht der Bedrijfsresultaten van de Gemeentegasfabrieken en eenige particuliere gasfabrieken in Nederland, in 1909." Bewerkt door P. Bolsius, 's-Hertogenbosch, M. van der Horst, Amsterdam, en G. A. Brender à Brandis, 's-Gravenhage. Vertrouwelijke Mededeeling. C. N. Teulings, 's-Hertogenbosch; 1911.

to the present volume. Fuller information is given in many respects than in the earlier annual volumes of statistics. The exhaustiveness of the present volume may be gathered from the following statement of the headings under which the particulars are arranged: Population of town and suburbs supplied; date of foundation of gas-works and name of present manager; amount of English and German coal carbonized, and make of gas per metric ton; quantities and nature of enriching materials used; total make of coal gas and of water gas; maximum and minimum make of gas *per mensem* and *per diem;* gas storage capacity of works; number of settings and retorts and their description, and extent of their use during year; number and description of water-gas generators, and amount and nature of materials used in water gas manufacture; illuminating power and calorific value of water gas made, and proportion of carbonic acid contained in it; consumption of gas for public lighting and by private consumers through ordinary meters and through prepayment meters, and consumption in other directions; make and quality of various bye-products; details of street lighting and of number of gas-meters employed; distributing pressure; length of mains in district; amount of oxide used in purification, and whether air is used for revivification *in situ;* average illuminating power of gas supplied and description of photometer used, and average calorific power of gas and description of calorimeter used, with number of times of testing. An appendix gives certain further particulars in regard to some of the works.

It will be seen how valuable to those interested in the gas supply of their country such a compilation is. We refrain from giving extracts from the information furnished by the statistics because the compilation is stated to be confidential. It is, we believe, primarily prepared for the use of members of the Dutch Association of Gas Engineers, which defrays the cost of its publication, but nevertheless is made accessible to any persons interested.

## LABOUR DISPUTES DURING 1910.

WHILE the entire population of the United Kingdom has its attention more or less focussed upon the strike fever which has lately, and with unusual severity, attacked various sections of the working classes, there is issued the report of the Labour Department of the Board of Trade on "Strikes and Lock-Outs in 1910." It is the twenty-third volume of the series; and it bears the signature of Sir G. R. Askwith. There is also dealt with the work of the Conciliation and Arbitration Boards; but this portion may be left over for notice on a subsequent occasion.

The disputes of last year are now a thing of the past; and when later statistics come to be prepared, they will probably be found to be more serious than those for the immediately preceding twelve months. At the same time, 1910 was, as the report points out, marked by considerable industrial disturbance. The number of workpeople involved in disputes commencing during the year was the highest since 1893; while the aggregate duration of all the disputes in progress during the year has been exceeded on only four occasions within the last eighteen years. This regrettable state of affairs was caused by great disputes in the coal trade of Northumberland, Durham, and South Wales, in the shipbuilding industry in the North of England and in Scotland, and in the cotton-spinning industry of Lancashire and Cheshire. These five disputes alone affected 265,100 workpeople at the establishments concerned, and involved a loss in time of over 6½ million working days. In addition to this, of course, there has to be taken into consideration the serious consequences to many persons indirectly affected. Of the 385,085 workpeople directly involved in the disputes commenced in 1910, 114,793, or nearly 30 per cent., were engaged in disputes on questions regarding the employment of particular classes or persons. This percentage was unusually high—a fact explained by the trouble in the cotton industry, which involved 102,000 workpeople, and arose out of the discharge of one man. Next in importance as regards numbers involved were disputes on questions of hours of labour, which accounted for 91,927 workpeople, or 24 per cent. of the total. Chiefly responsible for this figure were the disputes in the coal-mining industry of Northumberland and Durham over the re-arrangement of working hours entailed by the Coal Mines Regulation Act, 1908. Disputes regarding questions of wages affected 76,474 workpeople, or only 20 per cent. of the total. This is a cause of trouble which, in relation to the total number of employees concerned in disputes in any particular year, is always of a very fluctuating character. In the past ten years the proportion of workpeople involved in wages disputes (as compared with other troubles) has ranged between 79 per cent. and 20 per cent. Disputes on details of working arrangements were more numerous in 1910 than in any of the eight previous years; and cases arising from refusals to work with non-unionists, and out of other questions of Trade Union principle, were more numerous than in the two preceding years—the coal mining industry being responsible for the great bulk of them, owing to the sustained efforts of the South Wales Miners' Federation to compel all non-unionists to join their ranks.

A table which is of general interest is that showing to what extent the disputes of the year were settled in favour of the employees or the workpeople, or else were compromised. In disputes arising out of demands for increased wages, no more than 10 per cent. of the workpeople involved obtained complete success. There were, however, compromises representing some advance in wages arranged by 74 per cent. of the workpeople; while some 14 per cent. failed to gain anything. Generally speaking, disputes arising out of resistance to proposed reductions in wages were compromised. In all the wages disputes of the year, 8 per cent. of the workpeople directly involved were successful in attaining their objects, 14 per cent. were unsuccessful, and 75 per cent. effected compromises. Hours of labour disputes over the Coal Mines Act were amicably settled at a number of the collieries concerned. As to questions of Trade Union principle (in many of which cases the disputes were between one body of workpeople and another, and not between employers and employees) most of the strikes were successful; and in connection with troubles regarding the employment of particular classes or persons, the results were about equally divided. In other classes of disputes, the balance of success was, on the whole, against the workpeople. Taking all disputes of the year together, no more than 16·3 per cent. of the workpeople directly involved were completely successful in attaining their object; and this proportion, it is pointed out, would be materially reduced if disputes concerning the employment of non-unionists (which do not usually concern the employers to the same extent as other disputes) were excluded. The proportion of workpeople who were unsuccessful was 13·6 per cent., and of those who effected compromises 69·5 per cent. In a small number of cases no settlement had been arrived at when the year closed. The proportion of workpeople successful in the previous year was about 5 per cent. smaller than on this occasion, while that in favour of employers was 9 per cent. greater—3 per cent. more cases having been compromised in 1910 than in 1909.

The total number of disputes which began last year was 531, as compared with 436 in 1909, and 399 in 1908. The persons directly and indirectly involved numbered 515,165 last year, as against 300,819 in the preceding twelve months. The employees indirectly involved are those thrown out of work at the establishments where the disputes occurred, although not themselves on strike or locked out. Workpeople indirectly involved at other establishments than those at which the disputes occurred are not included. The aggregate duration of all the disputes in progress during the year amounted to over 9¾ million working days. In 1910, the mining and quarrying industries accounted for the greatest number of workpeople involved in disputes—that is to say, over 57 per cent.

The proportion of the total number of workpeople engaged in industrial operations who were involved in disputes last year (though the number of persons concerned was the highest recorded since 1893) was no more than 5 per cent.—which figure compares with 2·9 per cent. in the years 1909 and 1908. The proportion was again highest in the coal-mining industry, where it amounted to 28·9 per cent., and it was lowest in the building trades. The aggregate duration of all disputes in progress in 1910—9,894,831 working days—was about one three-hundredth of the whole number of working days available for the industrial population, exclusive of agricultural labourers and seamen. In other words, the amount of working time lost owing to disputes last year was less than one day per head of the industrial population. In the coal-mining industry the average loss of time was about five days per head of those employed; while in the metal, engineering, and shipbuilding trades it amounted to about two-and-a-quarter days per head. As is generally the case, the majority of the disputes were of short duration—259 of the 531 disputes which began in 1910, or 49 per cent., having lasted less than a week, while the proportion lasting less than two months formed 87 per cent. of the total.

Of the 9,894,831 working days lost in 1910, the mining and quarrying industries accounted for nearly 56 per cent. The amount of time lost by disputes in the coal-mining industry was 5,476,260 working days, and was, as a matter of fact, the highest figure recorded since 1898—the year of the dispute in the South Wales coalfield. This big loss of time was, of course, due to the protracted disputes in Northumberland, Durham, and South Wales. Other mining and quarrying industries accounted for only 47,900 days. Of the 224 disputes in the mining and quarrying industries which began in 1910, wages accounted for 122, hours of labour for 12, employment of particular classes or persons for 23, working arrangements for 37, Trades Unionism for 23, sympathetic disputes for 5, and miscellaneous causes for 2. Of all these questions, by far the greatest number of men were concerned in the twelve "hours of labour" disputes. The 23 trades unionism disputes ended as follows: In favour of the workpeople, 17; in favour of employers, 5. One case is classed as indefinite or unsettled. Altogether in the mining and quarrying industry, the proportion of workpeople directly involved who were successful in the disputes beginning in 1910 was 18·8 per cent., unsuccessful 14·2 per cent., compromised 65·8 per cent., indefinite or unsettled 1·2 per cent.

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We have received from the Principal of the Northampton Polytechnic Institute, St. John Street, Clerkenwell, E.C. (Dr. R. Mullineux Walmsley), a copy of the recently issued "Announcements" for the session 1911-12. There are day and evening courses in mechanical and electrical engineering, electro-chemistry, and technical optics; and in the evening classes a series of lectures on illuminating engineering will be given by various specialists. These lectures constitute an important development in the work of the Institute. The evening classes commenced last night; and the day ones will start next Monday. Full details of the syllabuses of the courses and the equipment of the Institute will be found in the "Announcements."

## HYGIENIC VALUE OF GAS LIGHTING.

THE current number of the "Illuminating Engineer" of New York contains an article on the above-named subject by Mr. R. F. Pierce, in the course of which he makes the following remarks.

One of the greatest advantages of gas lighting, and one that, strangely enough, has received little or no attention, is the highly beneficial effect upon the quality of the air in illuminated interiors. As this effect is not at all obvious, but on the contrary the reverse would, upon casual consideration, appear to be true, it is highly desirable that the facts in the case should be set forth in such a manner as to admit of the rational comparison of different illuminants in this respect. Many people carelessly and unthinkingly assume that because the burning of a gaslight discharges products of combustion into the room, a perceptible vitiation of the atmosphere must result. As a matter of fact, the precise reverse is the case; and this really constitutes one of the greatest advantages to gas over electricity for illuminating purposes.

The combustion of gas produces from a chemical standpoint four different effects upon the air taken from the room, mixed with the gas in the burner and discharged back into the room. These effects are: (1) The amount of oxygen is reduced. (2) The amount of carbonic acid gas ($CO_2$) is increased. (3) A very small amount of sulphurous gas ($SO_2$) is generally added. (4) Organic impurities and deleterious substances are removed by incineration. The first, second, and third effects are caused by the oxygen combining with the carbon and sulphur contained in the gas; and this oxidizing process generates heat in sufficient quantities to raise the mantle to the temperature of incandescence —1500° Fahr., which is sufficient to produce the fourth effect.

The physical effects produced upon the air are: (1) The temperature is increased. (2) The circulation of the air in the room is accelerated, and the ventilation from the outside is increased. As the quality of the air in the room at any time depends upon the interaction of the incoming fresh air upon the products of combustion discharged from the burners and the organic matter exhaled from the lungs and skin of the inhabitants of the room, it is necessary to investigate the inter-effects of all three.

On account of the tendency of heated air to expand, become lighter, and rise, the presence of any source of heat in a room produces a certain circulation of the air, which serves a double purpose. In the first place, the heated air is cooled by contact with successive portions of the relatively cool walls; and in the second place, the temperature in the upper portions of the room tends to increase, while that in the lower portion tends to decrease below that which would prevail without circulation. This produces an unbalanced pressure from the outside, tending to draw fresh air in at the bottom of the room through crevices, joints, and other openings, and also to a greater extent than is ordinarily realized through the walls themselves. The same action tends to expel the air in the upper portion of the room in the same manner; and this tendency is, of course, greatly augmented by increased facilities for ventilation.

As a gas-lamp produces about six times as much heat as a Mazda or tungsten lamp of equal illuminating power, it follows that the ventilating effect is correspondingly greater. At first thought, it might appear that the use of gas-lamps for ventilating purposes would be very inefficient, and that their effect would be practically negligible. While positive assurance derived from actual installations is submitted later on, it may be well to call attention at this point to the fact that in many chemical laboratories, where the air is being constantly vitiated by noxious vapours, the principal means of exhausting the contaminated air is through the use of an open gas-jet placed in a suitable vent. The ventilation produced must, of course, be far more effective than that required for any ordinary purpose, as the contamination of the air is exceptionally rapid. Of course, in making use of the ventilating properties of gas-burners, a balance must be struck between the amount of radiant heat generated and the rapidity of ventilation. It does not follow that the foulness of the air is always decreased by increasing the amount of heat generated in the room. This is, of course, perfectly obvious. The writer only purposes showing that under the conditions usually met in lighting practice the substitution of gas for electric lighting will generally produce this effect—other conditions being equal.

In considering the concurrent effects of light sources and the incoming air upon the average quality of the interior air at any moment, it is necessary to inquire into the nature and effects of the vitiating substances. Generally speaking, these are divided into two classes—those emitted by the respiration, both from the lungs and the skin of the people in the room, and those emitted by the illuminants. The first class includes germs of the diseases transmitted by germs, which, when taken from the air into the system through the mouth or skin, will produce their characteristic diseases. As a matter of fact, the supposedly fresh air from the exterior is often heavily laden with germs of this character. More commonly than any other are felt the effects of the vitiation produced by the organic matter in a greater or less advanced stage of decay exhaled by the lungs. This produces the stuffiness in a poorly ventilated room which is sometimes ignorantly attributed to carbonic acid gas.

As between gas and electric lighting, the former is the only one contributing any products of combustion whatever; and these are carbonic acid gas, sulphurous acid gas, and water. Carbonic acid gas is present in the purest of outdoor air in the proportion of about four parts in 10,000, and produces no discomfort or ill-effects if less than 225 parts in 10,000 of air are present. On account of the ability of gases to diffuse through even the tightest walls used in building construction, the proportion of carbonic acid gas in interiors rarely rises above 20 parts in 10,000, though for experimental purposes this proportion has been made as high as 50 parts in 10,000. This was accomplished only by resorting to exceptional means to secure a high percentage of this gas. Thus, practically speaking, it may be said it is impossible in practice to obtain enough carbonic acid gas in an ordinary room to produce the slightest effect upon the bodily functions, even when the most sensitive tests are employed to detect such effects.

Sulphurous acid gas when present is in such almost infinitesimal quantities that it is disregarded by investigators, so far as effects on the health are concerned, though unscrupulous or ignorant salesmen of lighting appliances frequently attempt to make capital of it. While it is in the quantities found entirely harmless to the human organism, it has a decided sterilizing effect as regards disease germs.

While it is true that carbonic acid gas artificially produced—that is, by the combustion of gas—is entirely innocuous in any quantity met with in human habitations, it must not be assumed that such quantities of this gas exhaled from the lungs may be regarded as an indication of sanitary conditions. On the contrary, even 15 parts of carbonic acid gas in 10,000, if arising from the respiration of human beings, indicates the presence of organic matter in such quantities as to be highly obnoxious or even harmful.

In this connection, it should be noted that the vitiation of air by human beings is generally expressed as a percentage of carbonic acid gas, because it indicates the amount of organic matter which has been given off in the same period; and while the latter (which is the real source of pollution) is difficult to measure, the carbonic acid gas is easily determined. From a sanitary standpoint, therefore, figures regarding the quantities in which carbonic acid gas indicates harmful conditions apply only to this gas when thrown off by the lungs, and not to the same gas produced by artificial means such as the operation of gas lights.

It is evident that the absurd practice of rating each gas-burner as equal to a certain number of human beings in vitiating the air in interiors is not only highly ridiculous, but precisely opposite to the dictates of common sense and the testimony of established facts; for the presence of gas-burners actually removes the vitiating matter.

[In order to substantiate these statements, the author summarizes very briefly the valuable paper contributed to the Royal Sanitary Institute about three years ago by Dr. Samuel Rideal, and given in the "JOURNAL," Vol. CI., pp. 613, 686.]

In the general summary, Dr. Rideal stated, first, that gas-burners give rise to stronger air currents and invariably produce a more active ventilation and diffusion of air than electric lights. Hence, along with the products of the gas-burner, the exhalations of the persons present were more rapidly removed. Secondly, the ascending currents of air from the gas lights on reaching the ceilings rapidly parted with their heat, which was conducted away by the rafters and joists. Thirdly, the electric lamps produced more heat than is commonly accredited to them; and this is the explanation of the unexpected result that the average temperature of the room was practically the same under either illuminant, and that the electric light did not show the superiority in coolness usually claimed.

While the careful and exhaustive tests of Dr. Rideal would appear to be most convincing as regards the absence of the noxious products sometimes ignorantly attributed to gas-burners, it may be worth while to note, for the benefit of the ultra-sceptical, that nearly all competent authorities agree that even if the carbonic acid gas contents of the air were increased (which is not the case) such increase could not produce ill-effects. Dr. Angus Smith shut himself in an air-tight chamber with a lighted candle, and remained until the candle was extinguished by the high carbon dioxide content produced (229 parts in 10,000); yet he felt no ill-effects. Dr. Richardson removed all the carbon dioxide from air that had once been breathed, and found that animals introduced into such air dwindled away rapidly and died. Pettenkofer found that 100 parts of carbon dioxide in 10,000 parts of air were not injurious to human beings; while one-tenth the amount of this gas derived from lung and skin exhalations rendered the air unfit for human habitation for any length of time. Proof of a similar nature from the experiments of recognized authorities might be multiplied almost indefinitely.

It would seem, therefore, that the bugbear of increased carbon dioxide content from gas-burners may not only be said to exist only in the imaginations of interested exploiters of competitive illuminants, but, furthermore, if it did exist, would be perfectly harmless. Another feature of even greater importance is the effect upon the eye. This subject has been carefully avoided by the antagonists of gas lighting with that discretion which is the better part of valour.

It would appear, therefore, that, in calling attention to the alleged shortcomings of gas lighting from a hygienic standpoint, its antagonists have only succeeded in shifting the burden of proof of the absence of unhygienic qualities on to their own shoulders.

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Dr. G. Marconi has been elected President of the Junior Institution of Engineers, in succession to Sir J. J. Thomson, F.R.S.

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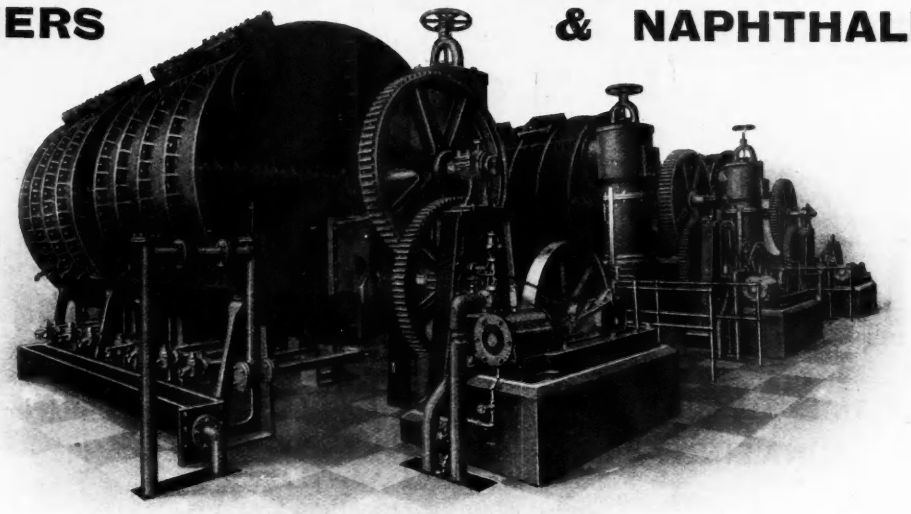

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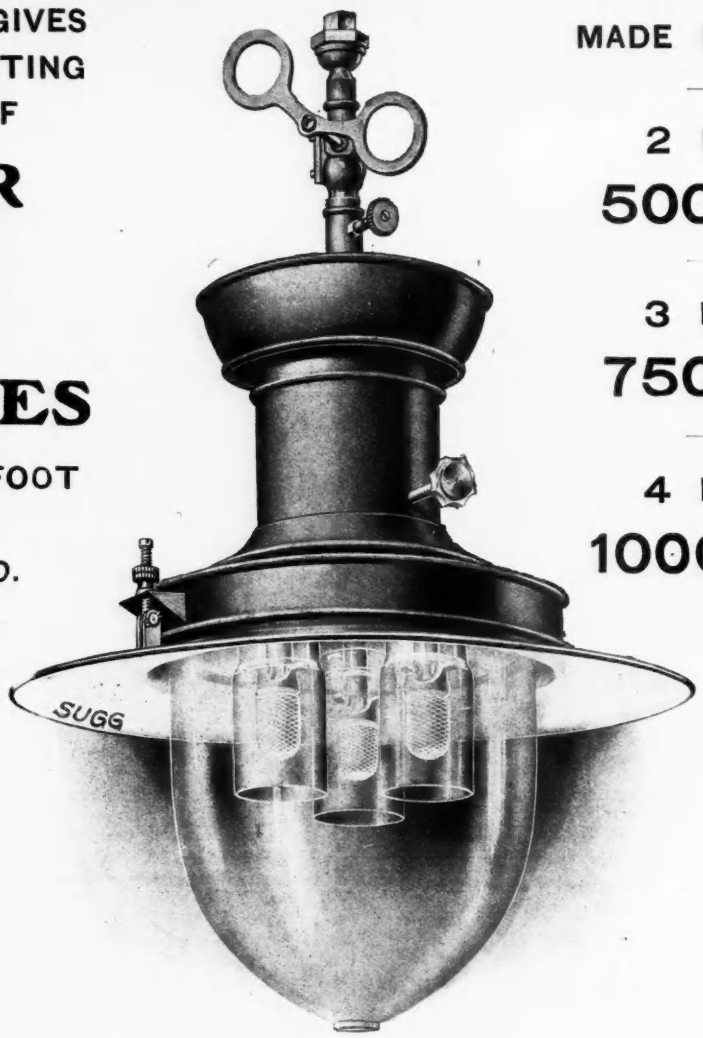


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# THE ELECTRICAL EXHIBITION AT OLYMPIA.

We can congratulate the electrical industry on the general character of their extensive exhibition at Olympia which was—following an inaugural banquet at the Trocadero Restaurant the previous evening—opened last Saturday by the veteran electrical expert (Sir William H. Preece, K.C.B., the President), and will continue open until Oct. 21. We can also congratulate the majority of the exhibitors upon the close completion of their stands by the opening day. They worked for most part zealously to that end; and their success is a pattern to others. We can further congratulate our competitors upon the interest that they managed to arouse in newspaper land prior to the exhibition. But nevertheless we cannot congratulate them upon the amount of interest that the public has shown, during the first days, in the display; but perhaps public patronage will come later, though there are groanings, sincere and deep, at the present neglect of electricity suppliers in the matter of buying admission tickets in bulk, and then distributing them gratis among the public. When a householder has to pay fares for himself and the supreme being in his domestic affairs to reach Olympia, and then to pay 1s. each for admission, for the purpose of inspecting what is purely an elaborate advertisement, he looks at the shillings to be expended, and calculates that it will go some way towards a better evening's entertainment at a theatre or elsewhere. The electrical papers have all administered to the electricity purveyors a little admonition on the subject; and the "Electrical Review" has warned them that that savage beast "the gas tiger is alert and athirst for the consumer's blood." This is strikingly characteristic; but it may serve its purpose of stimulating the apathetic suppliers.

## Hope, Glare, and Safety.

Great things are expected from the month's display, notwithstanding the inaction of the suppliers prior to the opening, and the irresponsiveness of the public on the occasion. One of our electrical contemporaries "hopes and believes that the exhibition will mark the turning-point in our industrial history;" and another says "it bids fair to mark a new era in the history of electrical progress." We shall see. Altogether the exhibition comprises some 300 exhibitors, occupying 330 stands. What they have to show proves a larger solid advance since the last exhibition on industrial rather than on domestic lines—limiting our observation to the part of the electrical industry with which we come into competition. In lighting, progress has been made in efficiency through the metallic filament lamp; but even so there is little in the exhibition of which we had not knowledge before, and nothing which (in view of the advances of gas lighting) occasions the slightest alarm. In some parts of the exhibition, the lighting is much overdone; and all the teachings of the illuminating evangelicals respecting the evils of high intrinsic brilliancy and of glare are here violated. So much so is this the case that those visitors who have any respect for their eyes had better go armed with coloured glasses. It is an instance of effect being sought by extravagance, which is altogether opposed to the rules laid down by electricians for obtaining economy. The smoked glasses are the only precaution necessary, if the visitors are endowed with sufficient nous to discriminate between the genuinely fair and the hyperbolic utterances of the stand attendants. On the ground of safety, there is as much assurance as can be given. We learn that the use of flexibles in the exhibition has been discouraged; and all wires within reach of the public, it was ruled, should be enclosed in wood casing, or other approved covering. Unenclosed conductors, too, it was ordered, should not be in contact with bunting or other inflammable material. Again, in the application forms for electricity supply issued by the management to the exhibitors, there is a most useful summary of the safety precautions necessary in wiring and illuminating stands. According to a paragraph in an electrical paper, we further observe that the Radium Fire Extinguisher Company, Limited, have made "arrangements to loan radium extinguishers to exhibitors for use on their stands during the period of the exhibition, at a nominal charge. . . . This extinguisher has proved its ability to deal successfully with fires caused by high-tension electric currents; arcs of 2000 volts having easily been extinguished under test conditions in London electric lighting works." Then Simplex Conduits, Limited (who in their advertisements appear to claim that safety in electric installation depends largely upon adopting their systems of wiring, to the exclusion of others) are showing a "Simplex" electric and petrol fire extinguisher, in which a fluid is used which is a non-conductor, and which will "therefore extinguish a fire on an electric conductor, whilst the current is on, and also a short-current in electrical machinery whilst in motion." Of course, we take it that the extinguisher is for use on systems of wiring that Simplex Conduits, Limited, do not supply. However, they particularly direct the attention of central station engineers to this fire-extinguishing appliance for use behind switchboards. The British Fire Appliances Company (whose extinguisher has been specified by the Metropolitan Police for service on electric motor buses) are also showing "efficient fire extincteurs." Further, touching the question of safety, we learn that the internal illumination of Olympia was placed in the hands of the Imperial Lighting Company, who themselves suffered from a fire recently at their works. It is also remarked that an inverted gas-lamp hangs outside the entrance hall, among the electric lamps—presumably for safety. So far we see safety is very well provided for by rules, appliances, and experience.

## A Large Range of Exhibits.

It is seen by the immense flashing sign on the front of the building that the main object of the display is to demonstrate lighting, heating, cooking, and power. But the heating and cooking appliances, especially the latter, sink into insignificance amid so much else in the actual display inside. Several exhibitors are showing cooking and heating appliances; but they are not so prominent as we imagined they would be. Our province is not to survey the exhibits in detail; but to indicate the enormous range of electrical goods on view, we may mention some of the classes. It cannot be to the ease of the minds of electricity suppliers to find how extensive are the private generating sets in the exhibition; and how persistent is the information that they are more economical and safe than taking a supply for lighting and heating from an ordinary distribution system, inasmuch as the cost of distribution and the distribution losses are saved, and there is less danger of collapse than will obtain on any central station system. There are also dynamos and motors. Among oil-engines, the Diesel and the Hornsby are prominent. The gas-engine makers are not generally in evidence on this occasion—in fact, the only suction-gas plant, so far as was observed, is the Hornsby. There are electrically worked coal elevators and conveyors, electric lifts, stokers for boilers, motors, power presses, mining appliances, meters (slots are not prominent), switchboards, fool-proof switchgears, wires and cables, batteries, electric lamps of all descriptions, electric heating and cooking appliances, electric signs, ventilating fans, switches, electric bells, hand and pocket lamps, lamp-globes, measuring instruments, medical appliances, telephones, wireless and other telegraphy, vacuum cleaners, knife-sharpeners, waterproofs, &c. It is a comprehensive and interesting show.

## Lamps and Lighting.

In connection with lighting, there is not much that calls for special notice here. The flame arc lamps—the competitors of our high-pressure lamps—are there flickering and spluttering in the same old manner. Efforts have lately been directed to secure with them longer burning hours, to effect much-needed improvement in the magazine type, and to get them down (even by sacrificing efficiency) to lower powers, with the view of producing them to compete with the metallic filament lamp. But we are afraid that the metallic filament lamp has cut the ground from under their shaky feet. The predecessors in the arc lamp line do not make any bold show on this occasion; but they still hang on—possibly hoping that, by some providential interposition on their behalf, they may obtain a new lease of life. The carbon filament lamp does not make much of a show. The metallic filament is the one upon which the electrical industry has almost universally placed reliance for ordinary purposes—the units for ordinary voltages (without the use of transformers) now running from fairly low candle powers (the equivalent of the bijou inverted gas-lamp) up to 1000-candle power. But the lamp about which the makers say much is the "Mazda" (of the British Thomson-Houston Company), with drawn wire filaments, which, it is claimed, have placed pressed filament lamps in the background. The wires being in "one continuous, uniform length" are described as wonderfully strong. The lamp, it is contended (what will the many other lamp makers have to say to this?), is a great advance over the ordinary kind, "where the filaments are in a number of short lengths, and so brittle that the slightest touch will shatter them." It is difficult to get an explanation of the advertised statement as to the lamp saving 75 per cent.—of what, of the current compared with the carbon filament lamp on an illuminating power basis, or compared with other makes of metallic filament, or of the actual cost for current? Makers of Osrams have at length produced a 200-volt 16-candle power lamp; and the British Thomson-Houston Company have what is called the "Gem" metallized carbon filament lamp, of 16-candle power, and requiring 45 watts an hour (or 2·8 watts per candle), or in a 20-candle form, requiring 50 watts (2·5 watts per candle). Of course, visitors are everywhere being told by attendants that the metallic filament lamp can easily beat even the newest forms of the inverted gas-lamp. It is their day out, and so we suppose they think they may take unlimited licence in statement. We see that in the very introduction of the exhibition catalogue, one Norman Staniland, M.Inst.C.E., gives a lead to licence. He is writing on house lighting, and talks of the old inartistic, inflexible gas-fittings. He says nothing of the new. His disingenuousness extends to this: "It was of no avail putting valuable wall papers, frescoed or stamped ceilings, into a room as permanent additions, if they were to be rapidly blackened or destroyed by the gas used; and apart from this destruction, the gas-lights could never be put into the most effective positions, either for decoration, or for general effect." What about the present? Gas-lamps are now put into richly decorated rooms without the destruction spoken of; and they can be placed to get fine decorative and general effects. He also speaks of that "tyrant of position gas-lighting." In connection with lighting, there is not much decorative glassware on view. Those visiting the exhibition will see that globes are indispensable with the metallic filament lamp, and will heartily endorse the view of Mr. Frank Bailey, the Managing-Director of the City of

London Electric Light Company, as expressed in an article in the "Electrical Review:" "All users of electric light are now anxious to secure relief from the glare of the metallic filament lamp; and as considerable progress has been made in the various forms of globes and shades to secure division and even distribution of illumination, the exhibition will be of great value in showing the public that a soft and subdued light can now be obtained." But at what price?

### Domestic Electrification.

The exhibition, it is hoped by some, will prove that electric cooking and the electric oven have now arrived at such a practical stage that they can enter into competition with the gas and coal heated oven in all respects. Messrs. John Barker and Co., Limited, have erected a handsome suite of rooms in the gallery; and we say, with perfect candour, that the display made is worth a visit. Everything has been arranged with exquisite taste. Here, in the kitchen, demonstrations are to be made with an electric cooker. The Berry Construction Company are also making demonstrations in the gallery. But we turn once more to Mr. Frank Bailey's article; and we read that, "as regards cooking, it is perhaps easier to show the apparatus at work than to give convincing proof that it will stand the test of time." In the, comparatively speaking, isolated cases in which electric ovens have been tried, we know how they have caused the proscription of cooks by masters or mistresses infatuated by the novelty of the thing, and believing all they have been told; we know of electric cookers having been laid aside or rarely used after a short trial; we know of electric cookers that have been discarded, and the reliable gas-cooker again fully installed in use. However, some optimistic writers think (as they thought at the time of the exhibition six years ago) that the electric cooker is the coming thing. But we are surprised, after what we had been led to anticipate by prior announcements, that the electric oven has not more prominence at the present show. Of the smaller type of domestic electric goods, there is an abundance, in the way of saucepans, grillers, frying-pans, potato-steamers, toasters, hot-plates, milk-heaters, kettles, water-jugs, urns, shaving-pots, curling-tongs heaters, flat-irons, sterilizers, and so on. But the prices! Of course, different makers, different prices. But prices do not vary much between the makers where the heating elements are part of the appliance; where they are not, then, of course, the utensils for use on cookers, hot-plates, and so on, are cheaper. But experience shows that where the heating elements are apart from the utensil, trouble arises directly the bottom gets misshapen, or out of the perfect flat. We can see the housewife looking hard at a 2-pint saucepan for £1 2s. 6d., or at a 12-pint one for £2—consumptions running from ½ unit to 1½ units per hour; or £2 7s. 6d. for a frypan using ¾ unit per hour; or £2 15s. 6d. for an 8-pint steamer using ¾ unit per hour; or 10s. 6d. for a 2-pint tin kettle, and £1 12s. 6d. for a 3-pint copper one; or £1 5s. for a 1-pint hot-water jug, or £1 10s. 6d. for a 3-pint one. And we can see an awful rush for electric flat-irons at the prices asked for them.

### Electric Cookers and Cooking.

As we have said, electric ovens are not so prominent at the exhibition as we expected to find them, though the makers who have had a shot at turning out cookers are many. Among them are Hawkes, Limited, the Berry Construction Company ("Tricity" cookers), Bertram Thomas, Ferranti, Limited, General Electric Company (Archer patents), Armorduct Manufacturing Company ("Therma"), British Thomson-Houston Company, Simplex Conduits, Bastian Heating Syndicate, Siemens Bros. and Co., British Prometheus Company, Eastman and Warne; and there are the "Therol" and "Eclipse" cookers. There may be other makers and other cookers. But this is sufficient to show how wide has been endeavour; how really small the practical result. At some stands, the most meagre of information could be obtained as to costs, results, life of elements, and the ovens themselves. The cost of ovens is steep. The "Tricity" single cooker is £3, to which has to be added £1 for a 12 inches square oven. A duplex cooker is priced at £5 5s.; and the addition for the oven is £2 (14 in. by 16 in. by 16 in.). There are the Prometheus ovens, which in appearance nearly approach gas-ovens. An oven 20 in. by 13 in. by 10½ in. inside dimensions, consuming 2 units per hour, is priced at £10; one 24 in. by 16 in. by 13 in., consuming 3 units per hour, is priced at £12; and one 26 in. by 20 in. by 18 in., consuming 5 watts per hour, is priced at £22 10s. Regarding consumptions of this type of cookers, it may be noted that "the power absorbed, where stated, is the actual power taken by the heaters after they have attained normal working temperature." What it is before, we have not ascertained. A Prometheus grill, 9 in. by 9 in. by 6½ in., is priced at £4; and a hot-plate, 6 in. by 6 in. by 4 in., at £3 3s. The Bastian people who run the "Quartzalite" cooking and heating apparatus, tell us that for fully twenty-five years spasmodic attempts have been made to popularize heating and cooking by electricity; but principally for the reason that the apparatus available has been very ineffective, fragile, and costly to maintain, such attempts have met with only slight success as regards heating, and as regards cooking practically no progress whatever has been made in establishing the oven and hot-water apparatus in the domestic household." By the application of quartz, however, they claim to have now succeeded where all others have failed. And yet Mr. Bastian seems to discount what he has hitherto done in the way of producing cooking apparatus by the claims made for his "hot box," referred to in our "Electricity Supply Memoranda." From a contemporary, it would appear that this "hot box" is a necessary adjunct; for Mr. Bastian is credited with saying: "I am perfectly certain that electrical cooking will never become a commercial possibility on any large scale without a practical system of thermal storage. Such a system I believe that I have devised by means of my 'hot box.'" But as to Bastian prices, we see that a hot-plate 5½ in. by 17 in. by 14 in. (using ¾ to 1½ units per hour) costs £4 4s.; and one 5½ in. by 24 in. by 24 in., £8 8s. One oven (weighing only 9 lbs.) to go over the hot-plate, measuring internally 16 in. by 11 in. by 12 in., costs 18s., while another (weighing 18 lbs.), measuring 16 in. by 20 in. by 12 in., costs £1 10s. The large Simplex electric ovens are also like gas-ovens. We take one with an oven 19½ in. by 12½ in. by 12 in., and find the cost is £8 12s. 6d. An enamelled top tray costs 3s. 6d.; and a switch-board, £1 5s. The loading is arranged as follows: Boiling-ring, 800 watts per hour (minimum 250 watts), grill, 900 watts; oven 2000 watts (medium heat 1200 watts, and minimum 800 watts). Simplex Conduits undertake to "repair or replace, free of charge, apparatus in which any electrical defect due to faulty material or workmanship is discovered; but they do not hold themselves responsible for *any consequential loss arising out of such defects*. . . . The guarantee does not apply to defects caused by wear and tear, accident, misuse, or neglect." There is a little reticence over the question of cooker wear and tear and maintenance costs among the exhibitors. It is difficult to get information as to the life of the heating elements. One attendant (the stand shall be nameless) gave the information that the firm he represented was the only one in the show that gave a guarantee for their cookers for as long as two years.

As to running costs, it is generally admitted, when the question is put point-blank that test costs are not likely to be the costs when in the hands of an ordinary domestic servant. There is not much information going on this point; but most of the attendants are prepared to assert that the costs under test conditions, at 1d. per unit are not more than for gas. But that is too vague for the ordinary man or woman of any intelligence; and there are many things electricians must necessarily explain in connection with the assertion. At the "Tricity" stand, three joints of meat were seen—one cooked by gas, one by coal, and one by electricity. "The very sight of that joint" (the one cooked by electricity) "tickles the palate," said the gentleman in charge. We looked at the highly coloured electro-cooked joint, and could not see anything special about it. The gas-cooked joint looked a bit over done, and the coal-cooked one—well its wasted look excited our sympathy. The loss of weight was a point. The coal-cooked joint had lost most (we were not surprised); the gas-cooked joint less (we were not surprised); the electricity-cooked one the least (again we were not surprised). The joints would not have been exhibited otherwise. But there was not such a fearful difference between the losses of the gas-cooked and the electrically-cooked joints. From a card picked up on the stand, we take the following:

*Economy of "Tricity" Cookers as compared with Coal Ranges.*
*Weight of Joints (Top Side of Beef).*

| | Coal. | "Tricity." |
|---|---|---|
| Weight uncooked | 5 lb. 4 oz. | 4 lb. 0 oz. |
| Weight cooked | 3 lb. 6 oz. | 3 lb. 8 oz. |
| Loss in cooking | 1 lb. 10 oz. (35·75%) | 8 oz. (12·5%) |

Therefore with "Tricity" cookers, 4 lbs. may be purchased, instead of 5¼ lbs. [There is something wrong with the arithmetic for the coal-cooked meat.]

But we got further along, and another attendant buttoned-holed us; and we learned there that the loss of electricity-cooked meat was so small that it was almost ridiculous to mention it; while gas-cooked meat gave up about 30 per cent. of its original weight—that is, as received from, and charged for by, the butcher. We went away wondering whether we should meet with an attendant who would tell us that, when a joint was put into a gas-oven, it disappeared altogether. We should not have been astonished. But, to return to the gentleman at the "Tricity" stand, he said the cost of cooking the three joints had been approximately the same—2¾d. and 3¼d. But he could not say which was the 3¼d. one. We have our suspicions. We learned of two other wonderful points about electric cooking. The "Tricity" gentleman seems to suffer from easily excited salivary glands. When he thinks of electrically-cooked food, his mouth fairly waters. As he is talking about electrically-cooked food so much, we expected to see the result about the stand, but failed. And the energy he has on electro-cooked food! His energy simply amazes him. That is the impression his information left on us. He never had so much energy when he took gas-cooked food. If loss of human energy through eating gas-cooked food is cumulative, it is marvellous that the British nation has made so much progress as it has done. We looked at ourselves and we looked at our informant. We thought of those thirty years that we have lived on gas-cooked food, and came to the conclusion that there was no particular reason for discarding our gas-oven, as he has done. He has it still in his house; but it is derelict. There is, however, not the slightest reason why we should not be the best of friends. His wares are not going to do infinite harm to the gas industry. However, we must leave electric cooking for the present; but still we cogitate on what will be the next phase in the romantic talk about electric cooking.

### Heating by Electricity.

Radiators are well to the fore in the exhibition; but their prices do not seem to recede much, and their efficiency does not improve.

A four-lamp radiator can cost anything from £2 to £5 10s. and upwards; renewal lamps 4s. and 4s. 6d. each; and the consumption is 1 unit per hour for each four lamps. We all know these radiators; and we all know that, without more than one is in use in a decent sized room on a cold day, comfort is out of the question.

WATER HEATING.

Water heating by electricity is also represented—the "Therol" being the principal exhibit in this line. But as we can do with gas in minutes what the "Therol" takes hours to accomplish, and as we can do it far cheaper, we will not discuss the matter here. If our electrical friends desire, we will do so on another occasion.

MISCELLANEOUS.

Among miscellaneous exhibits, we notice Messrs. Alexander Wright and Co. are showing a photometer for electrical work, various forms of recorders and calorimeters, and portable photometers (Simmance and Abady's patents). Messrs. J. W. & C. J. Phillips are exhibiting recording instruments, gauges, thermometers, and pyrometers; and Messrs. Bennis and Co. are showing recorders and calorimeters. Messrs. Falk, Stadelmann, and Co., Limited, Messrs. Everett, Edgcumbe, and Co., Limited, Messrs. Wallach Bros., and the Consolidated Pneumatic Tool Company are among exhibitors known to our readers. The London and Provincial Electrical Supply Authorities (known better under the style of the Electricity Publicity Committee) have a large stand, at which they will be pleased to attempt to proselytize any number of gas consumers who may present themselves.

## MANCHESTER UNIVERSITY LECTURES.

IN continuation of the movement originated by the Manchester and District Junior Gas Association, and supported by the Manchester District Institution of Gas Engineers, for promoting scientific work in the Manchester University by those interested in the gas industry, the following lectures have again been arranged for the ensuing session:—

1911.
Oct. 7.—"High-Pressure Gas: The Theory and Practice in its Application," by Mr. E. W. Smith, M.Sc. (Manchester), of the High-Pressure Gas Laboratory of the Birmingham Corporation.
Dec. 2.—"High-Pressure Gas: Some Aspects of Distribution," by Mr. E. W. Smith.

1912.
Jan. 13.—"Radio-Activity," by Professor Rutherford, D.Sc., Ph.D., F.R.S.
March 2.—"The Principles and Practice of Gaseous Heating," by Mr. Arthur Forshaw, M.Sc. (Manchester).

As was the case last session, these lectures will be given in the Chemistry Theatre of the University at 3 p.m.; and admission will be free to all who are interested in the gas industry, on presenting a ticket which can be obtained from the Hon. Secretaries of the District Associations—viz., Mr. W. Whatmough, Gas-Works, Heywood, and Mr. J. Alsop, "Laymarice," Edgeley Road, Stockport; or from the Bursar of the University. For those who have already acquired a knowledge of gas engineering, advanced courses of six lectures each have been arranged on "Theoretical Problems Involved in Incandescent Lighting," and "Chemical Aspects of Carbonization." The lectures in the former course will be given by Dr. Walter Makower, M.A., and Mr. E. J. Evans, B.Sc., Lecturers on Physics in the University; and the latter by Dr. Harold G. Colman. The fee for the two courses of twelve lectures will be 10s. 6d. to members of the Gas Associations, and £1 1s. to others. These lectures will be delivered on Thursday evenings during November, December, January, and February; the first being fixed for the 2nd of November.

### Mansfield's Automatic Water Finder.

Notwithstanding the investigations which have taken place in connection with the location of water by the aid of the "dowser," there still appears to be some doubt as to the possession by this individual of any special power in the direction indicated. But admitting that he has been endowed with a particular gift, it would seem that its exercise can now likely be dispensed with, as Messrs. W. Mansfield and Co., of Liverpool, have designed a simple portable apparatus, by means of which, as they claim, "any unskilled person may readily ascertain whether a subterranean stream or body of pure water exists under a spot where boring operations are desired." The principle on which the instrument works is the indication, by the movement of a needle, of the presence of currents which flow between earth and atmosphere, and which, seeking the path of greatest conductivity, are always strongest in the vicinity of subterranean watercourses, the waters of which are charged with electricity to a certain degree. The, presence of underground water flowing in a natural state only, and not in water-pipes or sources that have sprung up to daylight, is indicated. The instruments, which are constructed in sizes for locating water at depths up to 3500 feet, have been thoroughly tested in many parts of the world, and have always, the makers state, given the greatest satisfaction.

## FRENCH COMMISSIONS' REPORTS.

(*Continued from p. 734.*)

### COMMISSION ON DISTRIBUTION.

#### High-Pressure Gas Lighting.

The report of this Commission deals principally with the great progress of public high-pressure lighting; figures being given illustrating its development in Berlin and Paris, while London, Lyons, and Marseilles also come in for less detailed treatment. Observations are added on the important and auxiliary question of automatic lighting up and extinguishing of street-lamps. There may not be much (if any) information in the report that has not already been given in one form or another in the columns of the "JOURNAL;" but for our French colleagues and for ourselves, it is profitable to have attention directed succinctly to the present phases and future possibilities of public gas lighting.

High-pressure lighting enables burners of great intensity to be used, giving an excellent lighting efficiency, and therefore is naturally just now extending more and more. Eleven years ago, the Compagnie Parisienne du Gaz made the first installation of high-pressure public lighting in the Champ-de-Mars and the Trocadéro with Denayrouze and Bandsept burners, grouped in special lamps of the "Opéra" type, and supplied with gas at 200 mm. pressure. Visitors to the 1900 Exhibition will remember this. At that time the inverted burner was not known. This burner has the advantage of giving the maximum reflection from the light on to the ground, and of completely doing away with the cone of shadow. These advantages have led many towns to adopt it for public lighting, and in particular, the City of Berlin, where many tests have been made with it, both with high and low pressure gas. Such good results have been obtained, especially with the high-pressure gas, that the system has been largely extended in Berlin, as is shown by the following figures:—

BERLIN.

(A) Gas consumption for different methods of gas lighting from April 1, 1909, to April 1, 1910.

| | Cubic Metres. |
|---|---|
| 1.—Low-pressure gas— | |
| Vertical burners | 11,104,975 |
| Inverted ,, | 876,077 |
| Total | 11,981,052 |
| 2.—High-pressure gas— | 7,498,260 |

The consumption of high-pressure gas is, therefore, 38·4 per cent. of the total gas used for public lighting.

(B) Illuminating power in the public streets.

| | Hefner Units. |
|---|---|
| 1.—Low-pressure gas— | |
| Vertical burners | 2,242,855 |
| Inverted ,, | 314,820 |
| Total | 2,557,675 |
| 2.—High-pressure gas— | |
| Vertical burners | 594,200 |
| Inverted ,, | 3,614,400 |
| Total | 4,208,600 |
| 3.—Electric lighting— | |
| Arc lamps | 1,207,990 |
| Metallic filament lamps | 15,350 |
| Total | 1,223,340 |

It is interesting to note that the lighting power of high-pressure lamps represents 52·7 per cent. of the total illuminating power, including in it that from electric lighting.

(C) The total length of streets in Berlin (not including suburbs) lighted from the municipal gas-works is about 515 kilometres, distributed as follows:—

| | Kilometres. |
|---|---|
| (1) Lighted by low-pressure incandescent gas (vertical burners) | 424 |
| (2) ,, ,, ,, ,, ,, ,, (inverted burners) | 13 |
| (3) ,, ,, high ,, ,, ,, | 50 |
| (4) ,, ,, electricity | 28 |
| Total | 515 |

These figures show in what favour high-pressure gas lighting is held in Berlin. Moreover, the City allocates every year about a million marks to the extension of the system, and it is believed that the complete scheme of it allows for a length of 130 kilometres of high-pressure gas-main, corresponding to a total outlay of 10 million marks.

At present, there are five high-pressure stations; and the lamps used are the Auer (Pharos), Graetzin, and Selas. The lighting power of the lamps is 1000, 2000, and 4000 Hefner units. For these different systems, the pressure is the same—namely, about 1·40 m. of water.

While the hourly consumption of gas for the latest types of low-pressure inverted burners varies between 0·69 and 0·77 litre per Hefner unit (7·5 and 8·4 litres per carcel), with the high-pressure lamps, the hourly consumption per hefner unit is as follows:—

| | 4000 Hefner Units. | 2000 Hefner Units. | 1000 Hefner Units. |
|---|---|---|---|
| Selas | 0·57 litre | 0·53 litre | 0·54 litre |
| Graetzin | 0·48 ,, | 0·49 ,, | 0·52 ,, |
| Auer (Pharos) | 0·50 ,, | 0·48 ,, | 0·52 ,, |

This is equivalent to a consumption of 5·2 to 6·2 litres per carcel-hour.

A great advantage of public high-pressure lighting is the automatic lighting up of the whole group of lamps controlled by

the compressing station. The lamps are so arranged that, on starting the compressor, the gas pressure opens a valve, allowing free passage of the gas necessary for the normal working of the burners, which are lighted from a jet. The reverse takes place on stopping the compressor—the fall of pressure shuts the valve, extinguishes the burners, and the jet alone remains lighted.

Generally each lamp has three inverted burners. Of these, two are extinguished at midnight by means of an outside lever cock, while the third remains lighted till the morning.

### London.

As another example of intensive public lighting at low and high pressure with inverted burners, the City of Westminster is cited in the report. Here more than 2000 lamps are provided with "Nico" low-pressure inverted burners, arranged in two's, three's, or five's in one lamp, with a total of 7000 burners. The Gaslight and Coke Company have been successful in replacing 66 electric arc lamps by 1800 to 3000 candle power high-pressure gas-lamps.

### Paris.

The Compagnie Parisienne not having adopted high-pressure gas lighting, the public lighting of Paris was quickly outdistanced by that of Brussels, London, and Berlin. With the coming of the Société du Gaz of Paris, however, new tests were made in 1910 with intensive burners, of which the following summary is given.

I. *Low-Pressure Gas.*—After a short trial with the 1000-candle power "Soleil d'Or" lamps in the Boulevard de Palais, these were replaced by high-pressure lamps of the "Colonia" type, of the Société Auer, in accordance with suggestions made by the Gas Company. In Avenue Nicolas II. are "Gobo" lamps of 600-candle power, and in Rue de Châteaudun low-pressure Graetzin lamps of 1000 candles.

II. *Low-Pressure Gas with Compressed Air.*—This test was made in the Place du Châtelet; the compressed air being taken from the town system and reduced to 1·40 metres pressure. Single-burner Pharos lamps of 1000 candles were used. So far satisfactory results have not been obtained, owing chiefly to the moisture contained in the compressed air.

III. *High-Pressure Gas.*—Without doubt this of all systems tried in Paris has enabled the most brilliant, regular, and economical burners to be used. The upkeep is not high; and if a compressing station and separate main are required, these are compensated for by the marked saving resulting from the easy adoption of automatic lighting up and extinguishing. The following tests have been made:—

(1) In the Place de la Concorde with twelve Pharos lamps of 1200 candles, with two burners, and two Pharos lamps of 2400 candles, with three burners.

(2) In the Place de l'Opéra with six Graetzin lamps of 4500 candles, one of 2000 candles, and seven of 1000-candle power.

(3) In the entrance of the Gas Offices, 6 Rue Condorcet, with six Keith lamps, of from 1500 to 4000 candle power.

A large compressing station has been installed under the Boulevard Raspail to serve a considerable district. Two Roots compressors of 400 cubic metres are worked either by a vertical engine of 10 H.P. or by an electric motor of 15 H.P. At present they supply 88 Graetzin lamps of 2000 candles, and 28 Graetzin lamps of 4000 candles. The capacity of the station can be extended to 1200 cubic metres per hour. The total length of the main will be about 4500 metres.

The special model of lamp designed by the Société du Gaz has been used for this installation, each lamp being provided with a double supply to allow of reduced lighting after midnight. The brilliant lighting of the Boulevard Raspail has been a great success, and the Municipal Council has been favourably impressed by it, so much so that the Gas Company have shortly to submit a high-pressure scheme for the principal streets of Paris. This year (1911) there will be an extension of 209 lamps of 2000 candles and 35 lamps of 4000 candles. The complete scheme for all Paris will mean an expenditure of about 15 million francs for lamps, brackets, and service pipes only, exclusive of the mains and compressing stations, which may double the cost.

The net annual cost of lighting by high-pressure gas, compared with electric lighting, is wholly in favour of gas. The price for gas per 1000 candle-hours, including everything except sinking fund, is about 0·13 fr., whereas for electricity it is about 0·39 fr., or three times as much.

The power required for compressing may be taken at the outside as 3 H.P. per 100 cubic metres of gas per hour.

As to the diameter of the pipes, the Monnier-Pole formula is always applicable:—

$$h = 660\mathrm{M}\,\frac{\mathrm{ISQ}_2}{d^5}$$

where

$h$ = loss of charge in mm.;
I = length of main in metres;
M = coefficient of friction;
S = density of the gas;
Q = output in cubic metres per hour;
$d$ = diameter of the main in centimetres.

The coefficient M can be taken as = 0·003.

In fact, in the Lubeck-Travemuende installation (19·5 kilometres), it was found in practice that this coefficient varied, for a starting pressure of 1700 mm. and an arriving one of 50 mm., from 0·00295 to 0·0033, the diameter of the main being 80 mm., and the density of the gas at starting ·363 to ·389. In the installation from Lyons to Neuville [see paper* by M. d'Aubenton-Carafa at the 1908 Congress], the deviation between the loss of charge ascertained and that calculated after the same formula is very slight for a distance of 13,700 metres and a diameter of 150 mm. Moreover, the Monnier-Pole formula has given larger losses than actual losses; and it therefore appears that it can safely be adopted.

### Lyons.

Since October, 1908, the Lyons Gas Company have had at work a public installation of the Selas light, consisting of a mixing compressor driven by a small electric motor of ¼ H.P. running at 1500 revolutions. This system uses a mixture of air and gas in the proportion of 1 volume of gas to ¼ volume of air. The gas is first of all brought to atmospheric pressure, and the mixture is then sent by the compressor to the lamps at a pressure of 240 mm. of water. A bye-pass enables only the quantity of the mixture required for feeding the burners to be sent into the distributor.

The lamps have two inverted burners, with a total consumption of 1950 litres of gas per hour, or 2900 litres of the mixture. Tests made in the street have shown a lighting power of 360 carcels per lamp—that is, 8 litres of the mixture, or 5·4 litres of pure gas to the carcel. Since its installation, the working has been perfectly regular, and the lighting has been of remarkable intensity.

### Marseilles.

There remains to be noted the high-pressure lighting of the offices of the Société du Gaz de Marseille. The installation comprises a compressor of 10 cubic metres per hour at a pressure of 1·40 metres of water, worked by an electric motor of 2·3 amp. and 220 volts. It supplies, on the one hand, two Pharos lamps of 4500 candles, with three mantles, placed outside the offices; and, on the other hand, seven Graetzin lamps, of 100 candles, in the vestibule. The results being very gratifying, the Company have just put up, by the Bourse, six Pharos lamps of 4500 candles.

These examples of brilliant high-pressure lighting show a great future for gas lighting in spite of the competition of electricity.

### Automatic Lighters.

Without considering electric or pneumatic arrangements, which are rather rare, there are two classes of apparatus for lighting and extinguishing public lamps: (1) Apparatus working at a distance by pressure; and (2) apparatus working automatically by clockwork.

In France, the latter system has been largely adopted, while very few attempts with the pressure lighters have been made; whereas it is otherwise abroad, and especially in Germany. At Newcastle (England), an interesting comparative test is being made with 500 pressure lighters (of which 250 are "Bamag" apparatus, and 250 by Messrs. Alder and Mackay), and with 250 Hortsmann clockwork lighters. The number of miss-fires has reached 3·07 per lamp and per year for the first system, against 1·68 for the second.

In principle, the pressure system has several advantages over the clockwork:

1.—It enables lighting up and extinguishing to be done at any hour.

2.—The apparatus is simpler and, consequently, cheaper.

3.—Cost of labour and maintenance is generally less.

But, on the other hand, there are the following drawbacks:

1.—Bringing about the increase of pressure which, generally, would be at the moment of maximum output, may give rise to practical difficulties—for example, momentary overcharge of a gasholder.

2.—Insecurity in the lighting up or extinguishing, because the transmission of the pressure wave does not have an equal effect over the whole of the system. Hence many miss-fires affecting an entire district might occur.

3.—The meter dips might blow and cause an escape of gas if the syphon plug were not well screwed-up.

It is difficult to foresee which of the two systems will get the better of the other; the future will show. Abroad, each has its supporters. In France, up to now preference is given to the clockwork appliances. If they are dearer in first cost, labour, and upkeep, it must be recognized, on the contrary, that they have the advantage of making the lighting-up independent of the pressure conditions of the mains.

* See "Journal," Vol. CIII., p. 316.

**Origin of Lamp-Chimneys.**—An American journal recently had an interesting article on "Accidental Inventions," in the course of which it was recorded how Argand invented a lamp with a wick fitted into a hollow cylinder up which a current of air was allowed to pass—thus giving a supply of oxygen to the interior as well as the exterior of the circular frame. At first he used the lamp without any chimney; but one day, while he was busy in his workroom, his little brother, after amusing himself by placing a bottomless oil flask over different articles, put it upon the flame of the lamp, which immediately shot up the long circular neck of the flask with increased brilliancy. Very appropriately, the idea of a lamp-chimney flashed into Argand's mind; and after a few experiments, a new secret of great practical value was revealed.

# IN THE FLETCHER-RUSSELL SHOW-ROOMS.

### The Gas-Heating Season.

In these practical days, when folks look for the highest value for money expended, any article that depends on results for its name and favour must be capable of generating a high efficiency. That is so obvious that the statement is almost superfluous, except for the fact that it presents in the briefest manner and form the policy that underlies the work of Messrs. Fletcher, Russell, and Co., Limited, in the production of heating goods, of multifarious kind, in which gas is utilized. Their London show-rooms are rich in suggestion as to the enormous scope of the gas-heating business; and, before dealing with some of the Company's new season's productions, there are a few words to say about the show-rooms, which have been rearranged and reorganized, in order to make a compact and yet representative display, without a profusion that is often disconcerting and tiring to the purchaser. The ground floor has been arranged so that every type of goods can be readily examined; and at the rear, offices have been constructed, so that the whole of the staff is at ready command for attending to visitors and inquiries, as well as pursuing in close communication the ordinary business routine of the day.

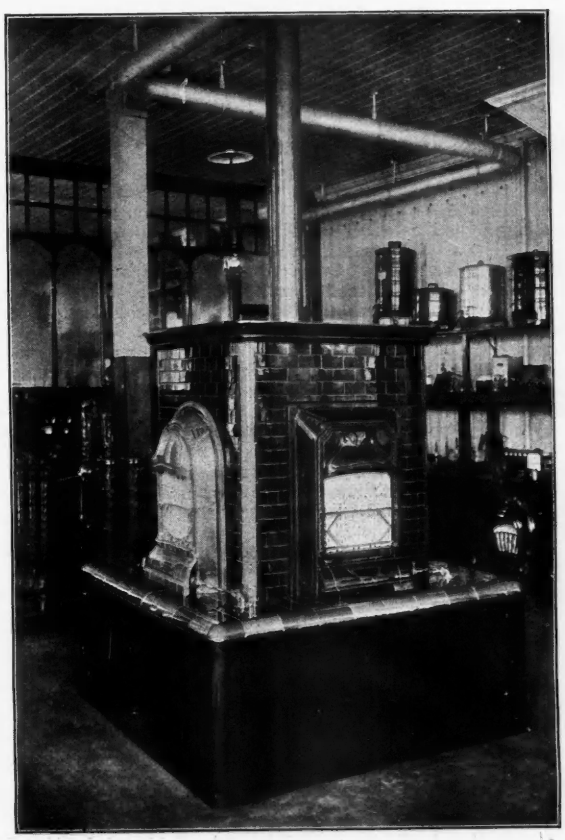
There is an attractive new feature of this ground-floor part of the establishment, that, copied by the show-rooms of gas undertakings, would make an equally attractive and exceedingly useful feature for them. The photographs will explain it. But briefly described, it is a four-sided pedestal, with raised projecting base, tiled so that each side represents the back of a fire-place recess with hearth. The tiles are of shaded olive green, which the firm find so popular among their customers. Rising centrally from

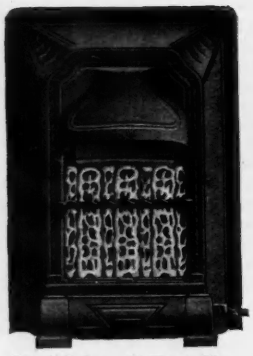
Views of the Gas-Fire Demonstration Stand in the Show-Room.

this structure is a flue leading into the permanent flue of the establishment. On this ingenious display stand, four different types of gas-fires can be shown in use at one time to the prospective purchaser, and yet without any one fire detracting from the individual examination of any one of the others. The idea may be recommended; and anyone interested connected with a gas undertaking is quite at liberty to call and inspect the actual thing for himself at Queen Victoria Street. There is another square structure in the room for the purpose of displaying fires fitted in cast-iron mantels—a class of goods for which the firm are very justly famed.

We descend to the basement, where samples of heavy and other goods not found fully represented in the show-room above are seen. There is an assortment of production, running from a gas flat-iron to the gigantic hot closets and cooking ranges for hotels and public institutions of all kinds. Here we have cookers small and large, fitted up in divers manners, hot-plates, vegetable-steamers, pot-stands, grillers (small and large), boiling-rings, and so forth. Here, too, are gas-fires—some fitted in mantels, some not; the mantels being made to imitate all kinds of woods, and fitted with a variety of tiles. Water-heating appliances for gas are exhibited in the form of geysers, boilers, coppers, and small horizontal heaters for lavatory basins, which are supplied by the firm on stands, fitted complete with mirror at the back, together with the horizontal water-heater. There are furnaces of all kinds for industrial uses. A long tube burner is seen for furnace work; and these burners can be made of any required length. There is also a bench, fitted with a hood and flues, where the use of muffles, crucibles, and other furnaces can be demonstrated. A coke stove and coke fire are also noticed; and in this connection one of the things that strikes the firm as singular is that, in these times when smokeless solid fuel is used in many dwelling-houses and other establishments, the use of coke-stoves is not demonstrated more freely by gas undertakings in their show-rooms.

Returning to the ground floor show-room, inspection is made of samples of the gas heating goods with which the firm are trading in the present season, when provision is being made for healthful comfort during the winter. Last year the firm introduced a new series of fires, in which they accumulated the good points of their old and modern experience, while conforming with the new order of principles and requirements. When we compare some of their





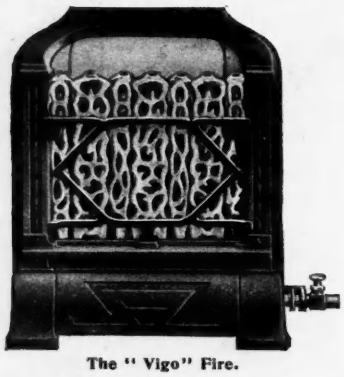
The "Palermo" No. 2 Fire.

The "Como" Fire.

The "Oporto" Fire.

The "Borneo" No. 2 Fire.

old types of fire with the new ones, there is found as much difference between them as there is to-day between the old horse omnibus and a motor bus. But the old types of fire had their good features—one being the firm's patent non-lighting-back burner, which for merit in efficiency takes a high place. The series that last fire season saw introduced—the "Palermo," the "Borneo," and the "Tokio" fires—were most successful, and met with a large amount of approbation, so much so, in fact, that many customers have expressed a desire that the designs shall not, for the time being, be changed, though trifling alterations in detail have been made to meet other requirements. It was also found that, with the spread of the use of gas-fires, there was a large request for fires of smaller heights, embracing modern improvements. This is one direction in which the firm have been working. In most houses there are rooms in which the fire-places are small; in the modern middle class house most fire-places are small; and the same applies to flats. In such rooms and fire-places, the normal sizes of fire look somewhat heavy, and do not in many cases fit very well in the fire-place space. Yet there is a desire that the gas-fire shall look like the proper thing, and not a mere toy. To meet this demand, the firm have made a third size of the "Palermo" and "Borneo" fires, retaining the range of heating power, but constructing them 2 inches less in height.



The "Vigo" Fire.

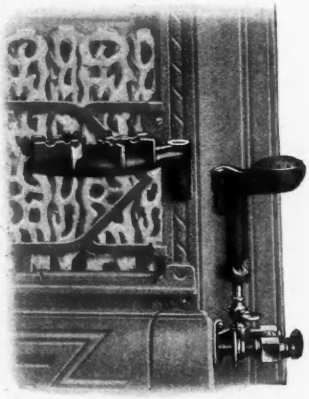
Both fires were produced last year in two sizes—respectively, 19 inches and 22 inches wide, 28 in. and 30 in. high, with fire openings 10 and 13 inches wide. So that the difference is in the height of last year's smaller size—that is to say, 26 inches, as against 28 inches. The "Tokio" fire has not so far been altered, except that purchasers can now have this (or any of the other types) with single or double fuel-bars just as pleases them. There is another point. Some of the fires (according to the type of casing) had no boiling-rings attached last year; others had them on the top. The present season's fires can be obtained with the boiling-ring on top or at the side, just as fancy dictates; and those that were innocent of any such provision last season can have a side boiling-burner this season. The convenience of a boiling-ring in most rooms is useful and is appreciated. In the case of this side boiling-ring, the burner is fixed, while the trivet itself is the only movable part; one effect of this being that the trivet can be swung in front of the fire for keeping anything hot without the burner being in use.

The majority of houses are rented in these days by tenants; and for this reason, and probably in some cases for pecuniary ones as well, the householders do not want to make any radical alteration in the fireplaces. In such cases, a shallow gas-fire that only requires the removal of the fire-bars of the old coal stove is a desideratum. Such a shallow fire has been introduced by Messrs. Fletcher, Russell, and Co. It is called the "Vigo;" and though small and shallow, it incorporates the modern features of an ordinary gas-fire. It is made in three sizes, for rooms up to 12, 14, and 18 feet square respectively, with 8, 10, and 12 inch fire openings. The appearance is shown by the illustration. For small offices, waiting rooms, &c., there is the "Oporto" fire (also illustrated), finished in black or aluminium. It is quite a small thing, being only 9¾ inches wide, 15½ inches high, and 4¾ inches deep, with a fire opening 7 inches wide. It therefore occupies little space, and the gas consumption is small; but the heating value is high.

Then there are two new nursery or bedroom fires. The first fire is of artistic design, and is known as the "Como." It has a removable fender, with copper reflector, and ornamental side wings. If the fender is not liked, there is an alternative in the "Como A," which is simply made with an ornamental base. It has a boiling-ring on top. The second fire is the "Palermo" 13 N fire; and with this, and the other new patterns of the present season, there is a range of bedroom and nursery fires which should meet all tastes and circumstances.

Concerning miscellaneous points, all the fires are fitted with the firm's-patent non-lighting-back burners (which, naturally, they believe to be the best on the market), with gas and air adjusters, and in most cases the burners can be reversed to suit right or left hand supply. The fuel is the firm's preference. It is columnar and triangular in section; and in ordinary fires, it is inserted alternately with the broad surface and the narrow part outwards, so that a very full radiating surface is given to the fires, without any distinct break between each column. The firm does not believe in the smooth-faced finish to the fuel; their contention being that it is useless to sacrifice duty to appearance in such a detail. Generally, the firm retains, too, the egg-shell surface for their fire casings, with dull black finish; but the latter may be had in enamelled finishes of various colours, as well as in ordinary black. The various fires, too, are made, as previously stated, with single or double fuel-bars as desired. In the case of certain of the fires, the parts are interchangeable.

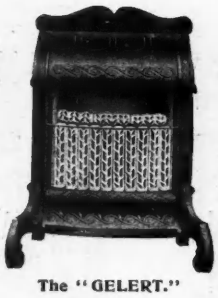
Regarding radiators, the firm's "Ivor" has been very popular; but in response to demand, they are now making it with plain columns, as well as in the ornamental form. This is simply a heat radiator without steam, and can be fitted up in any number of columns from two upwards. The plain form is known as the "Ivor P." It is flueless and non-condensing. Then there is the "Sypho" stove, which is condensing. This is the old No. 10 condensing stove, modified and modernized. It is very attractive, and can be fitted with a ruby chimney (which was popular last year) or a plain one, as required.



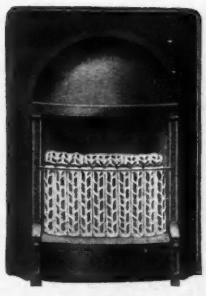
The Side Boiling-Burner, Showing Trivet Swung in Front of Fire.

To complete this notice of the firm's ability to fit any place with gas-heating appliances for any purpose, there are the water-heaters to be mentioned. The firm have been making a special line of these; and constructing them so as to give as little trouble as possible, while imparting to the user a high efficiency. Safety is provided for in every direction, metal (no leather or rubber is employed) is used throughout; and strength and durability have been the subjects of study. It is a big variety of water-heaters that the firm offers; and we cannot notice them all. But let us say that when, as, for example, with the "Ajax" and the "Hotspring" heaters, water can be promptly delivered at, respectively, 45° Fahr. and 40° Fahr. above the temperature of the cold water supply (without trespassing upon the duty kept in reserve as a margin), then no further recommendation is required.

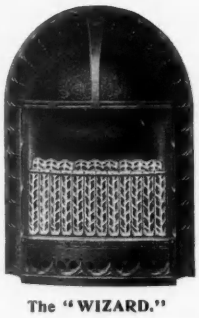
The "MASCOT."



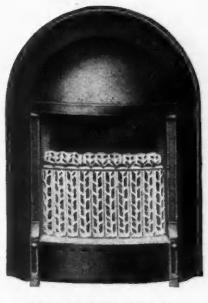
The "GELERT."



The "TALISMAN."

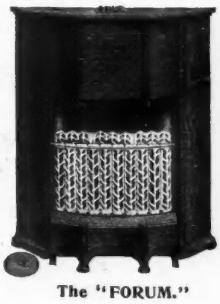


The "WIZARD."

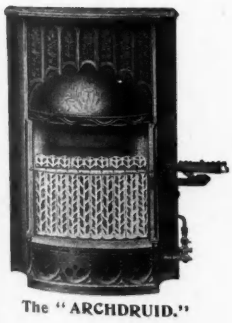


The "MERLIN."

The "WARLOCK."



The "FORUM."



The "ARCHDRUID."

The "DRUID."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# FORTY-FOUR

GAS FIRES of different sizes and patterns. All these are genuine distinct stoves made in cast-iron, and every one suitable for Hiring out by Gas Undertakings . . . . . .

YET ALL ARE MADE UP

FROM

## ONE SET OF PARTS

in each size—

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only the front castings are different.

THEY CAN BE HAD IN MANY DISTINCT STYLES OF FINISH.

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The Pioneers of Interchangeability and Standardization in the Gas-Stove Industry,

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No. 278.

The "SALON."

The Patent "N.V."

The "STADIUM."

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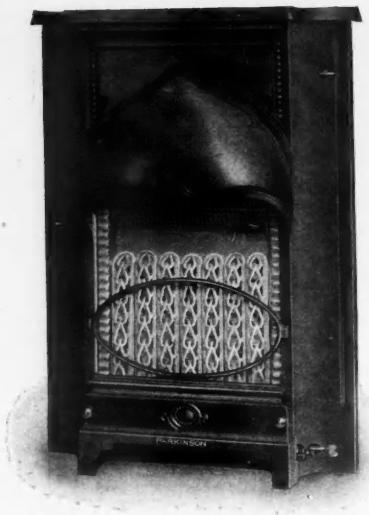
THAT ARE NOT CONSTRUCTED ON SCIENTIFIC AND PRACTICAL LINES

## AND RIGHTLY SO.

THE **P.S.C.** MODELS

***ARE*** Perfect Examples of Scientific and Practical Fire Construction.



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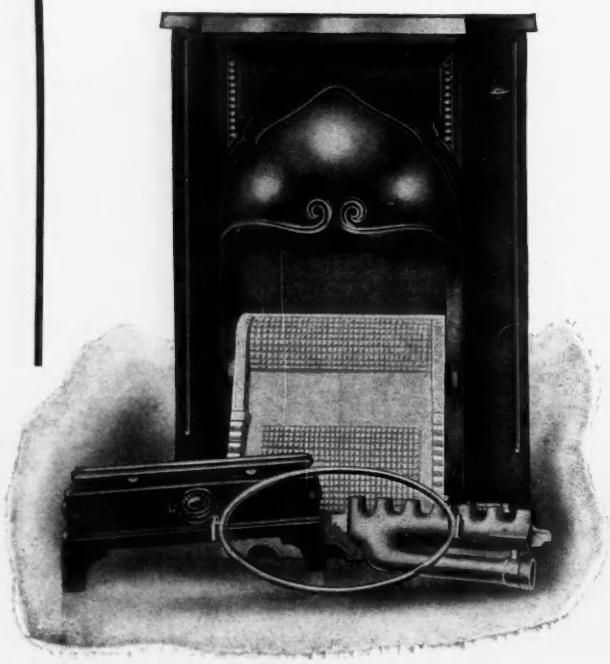
**THERE ARE NO COMPLICATED FITMENTS.**

Every part is designed to give **ABSOLUTE** Interchangeability, and the Illustrations show at a glance that we have succeeded in producing



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**Artistically Treated**

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AND THEREFORE

**Particularly Suitable**

FOR

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**PRICES from 21s.**

The "CRETAN," showing Interchangeable Parts.

THE PARKINSON STOVE COMPANY, LIMITED, BIRMINGHAM & LONDON.

# NEW GAS-WORKS FOR LEISTON.

## Opening Ceremony.

General View of the Works.

The town of Leiston (Suffolk), which has a population of 5000, has hitherto been supplied with gas from the private works of Messrs. Richard Garrett and Sons, Limited; but the growth of the town, and other circumstances, have rendered necessary the building of a larger gas-works. For this purpose, a Company was formed last year, with a strong local interest; and the services of Messrs. Corbet Woodall and Son, as Consulting Engineers, were engaged. The result has been the erection, for the Leiston Gas Company, Limited, of a works capable of producing 10 million cubic feet of gas per annum on land in Carr Avenue, adjoining the railway; the area of the site being about 1½ acres. Arrangements have been made with the Great Eastern Railway Company to construct a siding for the delivery of coal and other materials direct into the works. Though gas had been supplied for about six weeks previously, the formal opening ceremony was postponed until last Wednesday. An illustrated brochure prepared for the occasion contained the following description of the buildings and plant.

An Interior View of the Works.

All the buildings were let in one contract to Mr. A. Gibbs, builder, of Leiston. These comprise the retort-house, exhauster-house, meter and governor house, oxide-shed, store and workshop, and offices. The contract also included an underground tar-tank. The retort-house contains a bench of four arches designed to take settings of six retorts with modern regenerator furnaces. Two of these are filled with six and four retorts respectively, 21 in. by 15 in. ⌂ shaped, by 10 feet long; and the remaining two are left for future extension. The contractors for the retort-settings and ironwork were Messrs. George Winstanley and Co., of Birmingham.

The condenser, consisting of 10-inch cast-iron pipes (together with all works, mains, and connections, 8 inches in diameter), was supplied by Messrs. Cochrane and Co. (Woodside), Limited, of Dudley. The exhauster is of the rotary type, driven by a 4-H.P. gas-engine through a countershaft. The same engine also drives a battery of three pumps for tar, ammoniacal liquor, and water respectively. The rest of the apparatus, comprising a washer, scrubber, and purifiers, was all supplied by Messrs. Newton, Chambers, and Co., of Sheffield. The washer is of the well-known Livesey type, of a capacity to pass 250,000 cubic feet in 24 hours. The scrubber is a circular vessel filled with perforated steel plates; the diameter being 4 feet, and the height 20 feet. Provision is made (and connections are laid down) for four purifiers, two only of which are at present erected. They are of the luteless type, 10 feet square, and are supplied with suitable lifting apparatus.

The station meter, supplied by Messrs. Parkinson and W. & B. Cowan, Limited, of City Road, London, is of a capacity to pass 5000 cubic feet of gas per hour. The same firm have also provided an 8-inch district governor. The gasholder, of the spiral-guided type, which was erected by Messrs. Samuel Cutler and Sons, of Millwall, has two lifts, each 16 feet in depth; the total capacity being about 50,000 cubic feet. It works in a brick tank, built under a separate contract by Mr. Gibbs. The diameter is 48 feet, depth 16 feet. Provision is made for the building of a coal-store adjoining the retort-house; and the general arrangement of the works is such as to admit of the entire duplication of the plant, if the future demand renders it necessary.

The whole works have been built to the plans of Messrs. Corbet

Steel Main Laying in Progress.

Woodall and Son, under the supervision of Mr. Charles C. Seymour. Mr. Seymour (who was formerly a pupil of Mr. Thomas Glover, of Norwich) has also superintended the laying of the mains and services in the town and district, and is retained by the Company as Manager.

The mains, about 5 miles in all, are entirely of steel, commencing with an 8-inch trunk main from the gas-works to the centre of the town, and graduating down to 2-inch. The contract for steel tubes was divided between the British Mannesmann Tube Company, Limited, and Messrs. Stewarts and Lloyds. The jointing is on the Woodall-Parkinson system, with the long rigid, or sleeve, joint for the mains, and expansion nipples for connecting the services. All main-laying was tested to 10 lbs. or more of air.

The number of consumers transferred from the old mains was 47, and new consumers are being rapidly connected. The number of public lamps transferred was 72, to which are added 34 new ones; making a total of 106. The lamps are almost entirely refitted with new lanterns and inverted burners supplied by the New Inverted Incandescent Gas-Lamp Company, Limited. For lighting and extinguishing, the Robson patent pressure-clock apparatus has been adopted throughout, as supplied by the Auto-Lighter Company, of Victoria Street, S.W. By this system, a slight alteration of pressure at the works instantaneously operates the clockwork on all the lamps; and the clockwork either turns the light on or off as the case may be.

Mr. Frank Garrett, jun., a Director of the firm of Messrs. Richard Garrett and Sons, Limited, is the Chairman of the new Gas Company. Other Directors are Mr. W. H. Carr, of Leiston, to whose enterprise the undertaking largely owes its inception, Mr. E. L. Mansergh, M.Inst.C.E., and Mr. B. de Quincey Quincey.

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Over a hundred invitations to witness the opening were sent to the shareholders and friends, and to the members of the Urban District Council. The Directors were entertained at lunch by the Chairman of the Company; and they in turn provided tea in a marquee on the works ground for the visitors. Among the latter was Mr. Thomas Glover, of Norwich; while several other gentlemen from the Norwich Gas-Works also attended, as old colleagues of Mr. Seymour. Others present included Mr. Henry Woodall (of Messrs. Corbet Woodall and Son), Mr. George Winstanley, Mr. W. C. Parkinson, and all the members of the Urban District Council. The formal proceedings were very brief. The opening ceremony was performed by Mrs. Frank Garrett, jun., who unfastened the entrance gate of the works. The fastening specially provided for the purpose consisted of a gold bracelet (bearing a suitable inscription), which Mr. Henry Woodall, on behalf of the Engineers, asked Mrs. Garrett to accept as a memento of the occasion. In the course of his remarks, Mr. Woodall said the works were small, but well built; and the names of the various Contractors were known throughout the industry as being synonymous with very good work. He specially thanked their Secretary (Mr. B. R. Parkinson) and the Engineer-in-Charge (Mr. Seymour). The Company were to be congratulated upon having retained the services of the latter gentleman as Manager. The working results that he would secure from the plant would show that everything had been thoroughly well carried out under his superintendence.

The party then proceeded to inspect the works, which were generally admired for their neat and finished appearance, and for the completeness of their equipment.

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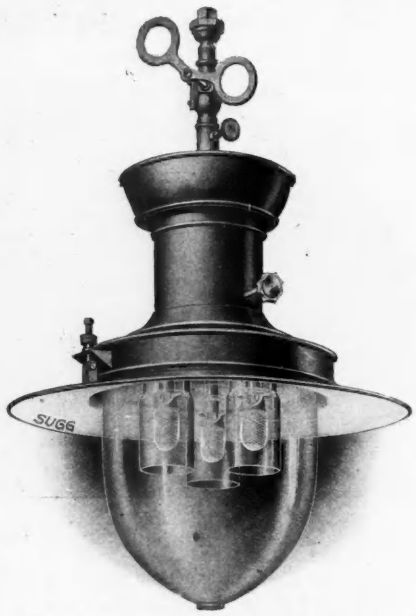
## HIGH CANDLE POWER AT LOW PRESSURES.

### William Sugg and Company's "1911" High-Power Lamp.

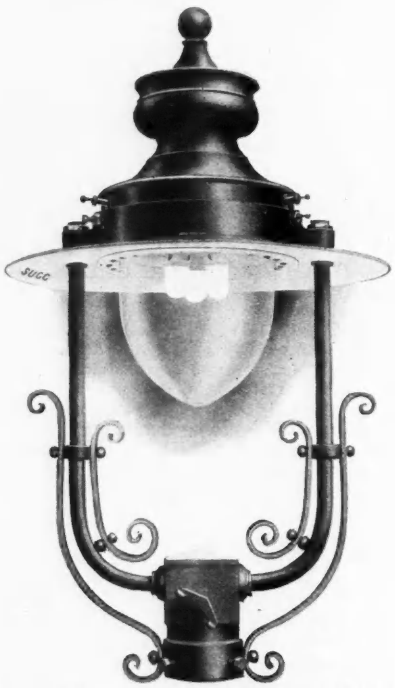
THE high efficiency lamp at low pressures for outside shop lighting, large interiors, and other suitable places, has, Messrs. William Sugg and Co., Limited, claim, been available for the gas industry for many months past in what is known as their "1911" type. It is a case of hiding one's light under a bushel when one does not make the broadest use of the means of publicity in announcing development of the kind. But we have now had an opportunity of thoroughly examining the lamp; and in it we find ingenuity and high duty combined with that high class workmanship which has assisted to make the name of "Sugg" a household word in the gas industry.

The "1911" type of lamp is made in three sizes—500, 750, and 1000 candle power; the lamps being respectively fitted with two, three, and four burners. The gas consumption of each burner is 6 cubic feet; and the efficiency, photometrically tested at 18-10ths to 20-10ths pressure, rather more than 40 candles per cubic foot. The lamp is really a development upon the previously popular "Regent" lamp. It is a lamp of exceptional strength—every part of the structure being of heavy metal, and all the vital parts so simple, so readily accessible, and so capable of replacement in a few minutes, that maintenance and renewal comprise a question about which there need be little thought. We have a strong interior cast-iron top, which carries the bunsen and the casing of the lamp. The casing is, according to the purchaser's desire, either of heavy copper or enamelled steel. The mantles are surrounded by interior glasses; and the glass bowl, which is carried on the hinged reflector, is egg-ended in shape. Incidentally, it may be remarked that the firm have a preference for this shaped globe, on the ground that it assists reflection, and affords a




**Sugg's "1911" High-Power (Low-Pressure) Inverted Lamp.**

better distribution of light. That is the lamp as seen externally. When, however, such high efficiency is obtained, at ordinary pressures, there must be some reason to account for it in the construction of the lamp; and in the "1911" lamp, the aim of Messrs. Sugg and Co. has been to put to the most profitable use the heat generated by the lamp itself. In preheating the gas and both the primary and secondary air to the utmost possible degree without producing trouble, they have been very successful; and, indeed, they confess that they do not well see how the point to which they have attained can be exceeded.




**The "Regent" Lamp with Upright Fixing for Street Lighting.**

Let us deal with the air supply first of all, as this is required for the mixture supplied to the burner as well as for the secondary supply to support combustion. The air enters from the outside of the lamp just above the reflector, passing first into an outer annular chamber formed by the central chimney and the casing. From this the air required for the secondary supply passes into a flat topped and bottomed cylindrical box, situated just above the mantles. Through this box are provided the necessary channels for the burners, and for the passage of the products of combustion. At the bottom of these channels are the supports from which the inner glasses depend. It follows from the position of this air-box that the air must get highly heated in its travel through it; and this hot air, by the draught set up and maintained by the upward heat currents from the burners, is drawn from the box-outlets near to the top of the inner

glasses, and becomes further heated by impinging on the glasses, and in its travel down the outside, and up the inside, of them. This hot air, and the velocity at which it passes up the glass and over the mantles (when once the lamp has warmed up to its work), no doubt have together an excellent effect in stimulating incandescence. By the constitution of the lamp, no air can get to its active parts, after the structure is heated up, that can have a cooling effect on either the flame or the mantle. Against this the designers of the lamp have effectively provided.

But that is not the only cause of the high duty obtained. There is the thorough admixture the gas and primary air obtain, and again it is the heat that produces the thorough intermingling. The gas has become partially heated in its descent; and after the introduction of the primary air, the mixture passes into an iron diaphragm, formed of two slightly concave plates in which it becomes further heated. The spreading of the mixture in this hot chamber has the effect of combining air and gas to such a degree that a very uniform and constant flame is obtained. The situation, however, of this diaphragm above the air-box is such that the mixture does not get so highly heated as to cause any back-pressure that cannot be resisted by the normal gas pressure. From the bottom of the thin mixing chamber, the mixture passes to the burner nozzles. Thus we see that the high efficiency of the lamp is due to preheating and thorough admixture, which are both provided for in such admirably simple and effective manner. The mantles used, which are suspended from a strong steatite nozzle, are somewhat larger than standard size. The adjustment of both gas and primary air are provided for externally.

There are a few miscellaneous points about the lamp. From the point of suspension to the bottom outer edge of the reflector, the length of the lamp is 21 inches, and the globe adds 10½ inches. The width of the reflector is 20 inches. Of the strength and the solidity of the lamp, mention has been made. But another feature is the ease with which the lamp can be taken to pieces, cleaned, and the parts reassembled. Strong screws and nuts are the main connections; and the fitter who, without previous instruction, could not see the way to separate every part of the lamp, and then to put the whole together again in a few minutes, would deserve to forfeit the title of "fitter."

Now we come to another point. As we have said, the lamp is a development on the firm's old "Regent" lamp, which has been selling in thousands to gas undertakings for hire purchase and purchase outright. The "Regent" lamp can be had fitted with the No. 6 mantle employed in the "1911" lamp; the advantage being that a more powerful light is obtainable without increasing the number of the burners or the size of the lamp. The efficiency is only slightly less than that of the "1911" lamp; and there are no inner glasses. Though no special provision is made for heating, from the very form of the construction of the lamp, it is obvious that the gas and air supply must get materially raised in temperature. Need we say, with all the experience there has been with the "Regent" lamp, it is one the firm particularly recommend for hiring-out purposes, on account of the ease of maintenance, and the cheapness of repair.

The "Regent" lamp is also made with upright fixing, as shown in the second illustration, which indicates what an excellent improvement, where adopted, it makes in the appearance of our street lamps, and consequently in that of our streets. In many places, lamps of this type have been fitted—among the localities, in Kingston and Kensington.

In connection with this and other patterns of their lamps, the firm have arranged a method of lighting by means of a flashing spirit torch, so as to obviate the necessity for a flash-light. A fixed tube, with a trumpet-shaped mouth, passes to the inside of the lamp. When the cock at the base of the lamp is turned on, the end of the flash torch is inserted in the trumpet end of the tube. A rubber ball at the other end of the torch rod is pressed lightly, and a small quantity of spirit is atomized, and blown across the permanent flame of the torch. This, becoming ignited, shoots a flame of ample volume into the lamp. It is a very effective method of ignition without opening the lamps; and it certainly saves the constant pilot.

In the lamps described, and in the other goods that were inspected, it was seen that the firm's old reputation for high-class work is being jealously guarded.

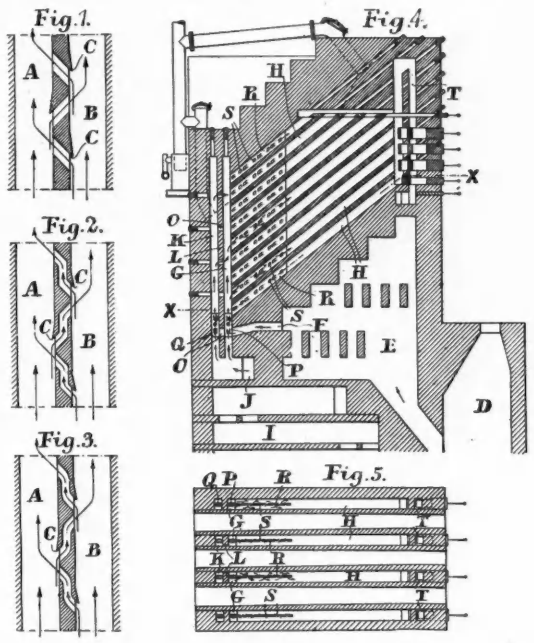
## THE MIXING OF HOT GASES AND AIR IN GAS-RETORT FURNACES.

In order to heat as regularly as possible the walls of the chambers in retort-settings—for example, in chamber retorts—it is important to have the hot gases mixed as thoroughly as possible with the air necessary for combustion, and not to allow this to take place suddenly at the spot where the gases meet the air, but be produced gradually. The Ofenbau Gesellschaft have patented a device by which, as they claim, this object is attained. It consists in constructing, in the partition between the heating-flue and the air-flue, transverse channels alternately running obliquely one to the other and in a straight or broken line or a curve. Owing to the effect of suction from the chimney, there is a gradual mixing of the hot gases and the air of combustion.

The accompanying illustrations show several examples of the constructure of the device. Figs. 1 to 3 represent, in vertical section, various arrangements of channels. Fig. 4 is a longitudinal section of a setting with oblique chambers in which the channels for the intake of the hot gas and air, as also those for heating, are constructed according to the invention. Fig. 5 is a horizontal section along the line X of fig. 4.

As shown by figs. 1 to 3, there are a number of channels in the partition between the heating-flue A and the air-flue B. These channels are oblique, and so arranged that they run alternately from right to left and left to right. As the result of this arrangement, under the influence of the chimney draught acting in the flues A and B, the hot gas is alternately drawn from A into B, and inversely the air from B into A, through the oblique channels; a gradual and complete mixing of the gas and air being thereby obtained. The orifices of the transverse channels are provided with an edge C in the form of a blade, projecting into the flues. This divides-up the relatively thin layers of the current of hot gas or air, and guides them into the channels. The oblique channels may be straight, as in fig. 1, in a broken line as in fig. 2, or in a curve as in fig. 3. They must, however, be arranged as baffles, so that the hot gases and the requisite air for combustion will be in turn conveyed from one channel to another, as indicated by the arrows.

In the setting with oblique chambers shown in fig. 4, the partitions with oblique channels in the hot gas and air intake flues produce a mixing of the hot gas and air; while, on the other hand, the channels constructed in the lower part of the heating channels running lengthwise with oblique transverse channels in their interior, produce an intimate mixture of gas and air in the heating channels themselves, and cause a perfectly uniform and gradual combustion of the mixture of gas and air.




The gas flowing from the producer D into the chamber E enters, through the channel F, the vertical channel G, where the heating channels H terminate. These are longitudinal, and are formed by two portions each near one of the sides of the chambers. The air required for combustion, having been previously heated in the regenerative furnace I, rises from the horizontal channel J into the lower part of the hot gas intake channel G and the air intake channel K, which is separated from the channel G by the partition L. In this partition there are openings O made at certain intervals, through which the gas and air intake channels G K communicate with each other. For the preliminary mixing of the hot gas and air, there are, at the lower part of these channels, partitions P Q, in which there are transverse channels either oblique or in the form of baffles. The effect of this arrangement is that the mixture of gas and air which forms in the lower part of the channels G K has an alternate to-and-fro motion in the direction of the arrows, and is thus subjected to a preliminary mixing.

In order to mix the combination of air and gas as thoroughly as possible, and cause its gradual combustion in the heating channels H, partitions R are constructed at the front of these channels, and in the partitions are transverse oblique baffle channels S. Consequently the mixture of gas and air formed in the lower part of the channels G K does not burn suddenly at the place where the hot gas and air meet, but is first mixed by the perforated partitions P Q, after which it ascends in the channels G K to reach the heating channels H, where it burns gradually and uniformly. It is claimed that the retort chambers bounded on the sides by the heating channels H are heated with great uniformity.

In the type of setting shown in fig. 4, the hot gas escapes through an outlet channel T at the back of the setting.

# NAPHTHALENE IN COAL GAS.

Three papers dealing with naphthalene in coal gas have appeared in recent numbers of the "Journal für Gasbeleuchtung."

### Oils for Naphthalene Extraction.

The first, by Herr A. Bayer, of Brünn, deals with oils for the extraction of naphthalene from gas by washing. Two washers for naphthalene extraction were introduced at the Brünn Gas-Works in the year 1900; but they were intended to deal with a make of only 350,000 cubic feet per diem, whereas the maximum daily make of the works is about 954,000 cubic feet. Hence the washers were worked in winter above their nominal capacity, and the rate of flow of gas through them when they were worked in parallel was as high as 0·44 foot per second. In order to avoid importing the comparatively expensive heavy oil prescribed by Dr. Bueb, attempts were made to use a lighter tar oil, which was fairly free from naphthalene. This tar oil contained 68 per cent. distilling over below 180° C. and 25 per cent. distilling between 180 to 230° C. It contained 3·9 per cent. of naphthalene. After use for two months, the gas passed per cwt. of oil being approximately 300,000 cubic feet, the naphthalene in the oil had increased to 19·1 per cent.; while the oil contained 14·9 per cent. of benzol and 42·7 per cent. of heavy oil—*i.e.*, oil distilling above 230° C. The light oil and middle oil had been reduced to 18·1 per cent. The heavy oil was no doubt largely derived from tar in the washer; but the analyses showed that a great deal of benzol had been absorbed in the washer and much light and middle oils carried away by the stream of gas. Experiments were then made with oil of the same grade, but with the washer maintained at a temperature of 46° to 50° Fahr. It was found that the benzol was extracted and the light oils volatilized from the oil, but both to a smaller extent than in the first trial. The oils after use contained from 17·5 to 28·9 per cent. of naphthalene. The gas in the distributing main was found to contain, on an average, 2·5 grains of naphthalene per 100 cubic feet.

After the washer had been in use for half-a-year, it was reported that more condensed liquor was being found in the syphon pots. Samples of the liquid were taken and analyzed. They proved to contain from 18·9 to 27 per cent. of naphthalene, probably derived from the deposits of solid naphthalene in the distributing system. The proportions of light and middle oils in the condensed liquid differed, however, according to the position of the syphon from which it was taken. In the syphons on the works the ratio of light oil to middle oil was on an average 63 : 37, while in the distributing mains, at points 500 to 3000 metres from the works, it was 77 of light oil to 23 of middle oil. The proportions correspond, however, on an average, pretty closely to the proportions of light oil and middle oil in the oil used for washing; so that it would appear that the stream of gas removes the two sets of hydrocarbons from the oil used in about the same ratio. The proportion of benzol in the condensed liquid removed from the syphons was, however, greater relatively to the light and middle oils the farther the syphons were from the works. Disregarding naphthalene and heavy oil in the condensed liquid, the constituents were in the following ratios: In the liquid from the syphons on the works, 11·7 of benzol, 63 of light oil, and 37 of middle oil; in the liquid from the syphons on the distributing main, 17·7 of benzol, 77 of light oil, and 23 of middle oil. From the differences between these figures, it appears that in the condensed liquid there is an increase in benzol of 50 per cent. between the works and the district, in the light oil of 22 per cent., and a decrease in the middle oil of 30 per cent. These figures represent the amounts of the respective hydrocarbons abstracted from the stream of gas between the works and the district. The hydrocarbons which exist in coal gas in the form of vapour or fog are, therefore, deposited in the distributing mains in amounts inversely proportional to their boiling points, as also to the friction, which depends upon the length of the main through which the gas has travelled. The quantities of condensed liquid were not determined; but so far as the works' syphons were concerned, they corresponded to about 1 cwt. per 12,000,000 cubic feet of gas, or about 3 per cent. of the amount of oil used in washing. In the mains in the district, the proportion was much smaller.

After a year's working of the naphthalene washers with light tar oils, naphthalene deposits in the distribution system ceased almost entirely, and the gas-pressure diagrams were quite satisfactory. A tar oil fulfilling Dr. Bueb's specified conditons was then used—viz., one having its specific gravity above 1, and containing a high proportion of heavy oil. Though such oil would have a lower solvent power for naphthalene, it seemed probable that it would prevent stoppages in the distributing system, and at the same time avoid the smoking of mantles in the public lamps which had occurred in a few instances during the use of the lighter oil. The oil used contained 1·4 per cent. of benzol, 7·8 per cent. of light oil, 22·2 per cent. of middle oil, 3·1 per cent. of naphthalene, and 65·5 per cent. of heavy oil. The oil after use in the washer contained 4·7 per cent. of benzol, 19·7 per cent. of light oil, 24·4 per cent. of middle oil, 6·3 per cent. of naphthalene, and 44·9 per cent. of heavy oil. There was an increase in the weight of the oil on use in the washer of about half its original weight.

The naphthalene extraction was much less satisfactory than with the lighter oil, and deposits of naphthalene in the works' plant increased. The difference from the favourable results obtained with heavy tar oils in other places may be accounted for either by the high rate of flow of the gas through the washer or by the large quantity of water which was condensed in the washer and which floated on top of the heavy tar oil and moistened the grids of the apparatus, so that the active oil surface was diminished. As a consequence of these results, trials were next made with a mixed oil having a specific gravity below 1, and having the following composition: Benzol 1 per cent., light oil 3·3 per cent., middle oil 31·4 per cent., naphthalene 2·3 per cent., and heavy oil 62 per cent. The composition of this oil after use was as follows: Benzol 5·3 per cent., light oil 12 per cent., middle oil 28·7 per cent., naphthalene 10·6 per cent., and heavy oil 43·4 per cent. It appeared from the analyses that the light and middle oils taken up by the washing oil were in almost the same proportion as that in which they existed in the deposits in the distributing system—about two-thirds of light oil to about one-third of middle oil.

During the trials with heavy oil and the mixed oil last mentioned, tests were made from time to time of the amount of naphthalene in the gas in the distributing system, and were found to average with the heavy oil 35·3 grains per 100 cubic feet, and with the oil of specific gravity below 1, 21·2 grains per 100 cubic feet. It would appear from the results recorded that the lighter tar oils answer best for the extraction of naphthalene, because the heavy oil and the mixture of heavy oil and middle oil do not possess the requisite absorptive capacity. That the heavy oil has given satisfactory results in other places, is probably due primarily to the amount of oil used not being less than 1 cwt. per 250,000 to 300,000 cubic feet of gas. The diminution of the effective surface of the oil by the covering of condensed water is, however, of great importance in regard to the use of heavy oil.

The analyses of the tar oils and condensed liquids referred to in the foregoing were made by distilling the oils in the usual way; but the naphthalene was estimated gravimetrically. The fraction distilling between 180° and 230° C., after being measured exactly, was exposed for four to six hours to a temperature of 0° C. The naphthalene which had then crystallized out was brought on to a small tared and cooled porcelain filter, completely extracted by means of an air-pump, and weighed. For the naphthalene remaining dissolved in the liquid a solubility coefficient of about 10 per cent. was adopted, and introduced in the calculation. This was substantiated by determinations of the proportion of naphthalene in the oil by means of picric acid. The method of working was rapid and convenient; and, if not absolutely exact, it gave comparable results.

### Tars for Naphthalene Extraction.

Herr Zwarg, the Manager of the Elbing Gas-Works, has made experiments on the use of the tar produced in the manufacture of carburetted water gas for washing coal gas for the extraction of naphthalene. The oil used in the carburetted water-gas plant was Galician oil having a specific gravity of ·87. The tar produced therefrom somewhat resembles in composition that made in vertical retorts, as is shown from the following statement of their respective compositions:—

| — | Oil-Gas Tar. | Vertical Retort Tar. |
|---|---|---|
| | Per Cent. | Per Cent. |
| Water | 1·0 | 2.17 |
| Light oil distilling below 170° C. | 6·5 | 5·85 |
| Middle oil distilling between 170° to 230° C. | 9 0 | 12·32 |
| Heavy oil distilling between 230° to 270° C. | 18·5 | 11·95 |
| Anthracene oil distilling above 270° C. | 42·0 | 15·96 |
| Specific gravity | 1·068 | About 1·1 |

On cooling the middle and heavy oils to 10° C. naphthalene amounting to about 6 per cent. of the tar separated, as compared with about 10 per cent. in the vertical retort tar. The solvent power of the oil tar for naphthalene at 77° to 86° Fahr. was determined, and it was found that 28 to 30 per cent. of naphthalene was dissolved. The behaviour of gas free from naphthalene with the oil-gas tar containing 6 per cent. of naphthalene was ascertained by passing gas through a wash bottle containing 5 per cent. of oxalic acid, then through two cylinders charged with saturated solution of picric acid. The gas thus freed from ammonia and naphthalene was next passed through a bottle containing the oil-gas tar, after which it was passed through a bottle containing 5 per cent. of oxalic acid and two cylinders charged with picric acid. The naphthalene absorbed from the oil-gas tar was removed in the latter cylinders and determined by titration with decinormal solution of caustic potash. The amount of naphthalene in the gas was thus found to be 2·3 grains per 100 cubic feet. When the gas, however, after passing through the oil-gas tar, was passed through a bottle containing clean anthracene oil, most of the naphthalene was retained by the latter, and the gas then contained only 0·175 grain of naphthalene per 100 cubic feet. The temperature of the gas and tar in these experiments was kept at 59° Fahr. It thus appears that naphthalene washers cannot be charged with oil tar alone if the proportion of naphthalene in the gas is to be kept below 2 grains per 100 cubic feet.

In working on the large scale, the first or inlet chamber of the washer was charged with oil tar and the second or outlet chamber with anthracene oil. It was found in practice that it was best to renew the oil-gas tar when a sample, on distillation, gave about 21 per cent. of naphthalene in the fraction distilling between 200° and 270° C. The anthracene oil from the outlet chamber was pumped into the inlet chamber when 1 to 2 per cent. of naphtha-

lene separated from the fraction distilling between 200° and 270° C. upon cooling for one hour. The method of working has been to start with oil-gas tar containing 5 per cent. of naphthalene in the inlet chamber, and anthracene oil free from naphthalene in the outlet chamber. The oil-gas tar in the inlet chamber has been renewed when the amount of naphthalene in it has risen to 24 per cent. When the second charge of oil-gas tar has subsequently been exhausted, the anthracene oil in the second chamber has contained 2 per cent. of naphthalene, and has been pumped into the first chamber, while fresh anthracene oil has been put into the second chamber. When the anthracene oil in the first chamber has contained 22 per cent. of naphthalene, it has been replaced by oil-gas tar, which, in turn, has been replaced by the anthracene oil from the second chamber when the latter has acquired 1·5 per cent. of naphthalene.

By this method of working, it has been possible to maintain the proportion of naphthalene in the washed gas at about 1 grain per 100 cubic feet. It has thus been found that the anthracene oil could not continue to be used up to a content of 28 per cent. of naphthalene, because in that case the anthracene oil in the second chamber acquires more than 1 per cent. of naphthalene. The trials showed broadly that oil-gas tar is not applicable by itself for the extraction of naphthalene if the proportion remaining in the gas has to be maintained below 1¾ grains per 100 cubic feet, and that with a washer containing only two chambers the anthracene oil cannot be used long enough to allow it to become completely saturated.

### Determination of Naphthalene in Crude Coal Gas.

The last of the three papers is by Herr A. Albrecht and Dr. F. Müller, of Fürstenwalde on the Spree. It relates to the determination of naphthalene in crude coal gas. The authors state that they have used picric acid for the determination of naphthalene in gas by the following method. First, 2·5 grammes of picric acid are divided nearly equally between two wash bottles, each of 110 c.c. capacity; and 25 c.c. of water is added to each, with vigorous agitation. A second quantity of exactly 2·5 grammes of picric acid is dissolved in water, and made up to 250 c.c. in a measuring flask. This corresponds approximately to a saturated aqueous solution at 50° to 54° Fahr.; so that it can be used in a cold room without depositing picric acid. The gas containing naphthalene is passed at the rate of 40 to 50 litres an hour through the wash bottles, which are connected with butt glass joints. The passage of the gas is continued till between 0·05 and 0·2 gramme of naphthalene has combined with the picric acid. The contents of the two flasks are then washed into a 250 c c. measuring flask and warmed for half an hour (with frequent agitation) to 104° to 122° Fahr. in a water bath, so that all the free picric acid is taken into solution.

After cooling to the temperature of the control solution, the flask is filled up to the mark; the solution filtered through a dried filter; and 100 c.c. of the clear filtrate is titrated with decinormal solution of caustic potash with lacmoid as indicator. The control solution of picric acid is similarly titrated, and the titration in both cases is repeated. The difference in the number of cubic centimetres of solution of caustic potash required for 200 c.c. of the two solutions is multiplied by $\frac{5}{4} \times 0{\cdot}0128$; and the result is the quantity of naphthalene, in grammes, retained in the two wash bottles, and therefore the amount present in the volume of gas passed through them. The accuracy of the method has been checked by passing dry nitrogen over a weighed quantity of naphthalene and determining the naphthalene in the nitrogen. The results have shown fairly close agreement with the loss of weight of the naphthalene over which the nitrogen has been passed.

The examination of crude coal gas by this process gave such low results that their correctness seemed doubtful. Sawdust, dried ferric hydrate, and dilute sulphuric acid had been used to retain the tar, cyanogen, sulphuretted hydrogen, and ammonia in the crude gas. The vessels charged with these purifying materials were placed in a drying oven, which was kept at a temperature of 95° to 104° Fahr., while the gas was passed through them. Nevertheless, the purifying materials must have retained the greater part of the naphthalene. This was proved by passing nitrogen containing naphthalene through purifying apparatus which had been previously used, but was otherwise unchanged. On warming to 104° to 122° Fahr., the amount of naphthalene found in the nitrogen was at first considerably higher than that in it before its passage through the purifier, but subsequently considerably lower. Thus the nitrogen had in the first instance taken up naphthalene which had been retained in the purifier from the gas previously passed through it; but subsequently the purifier retained about 40 per cent. of the naphthalene in the nitrogen.

In order to clear up this point, a number of tests were made on various purifying materials, by passing nitrogen containing naphthalene through them while maintained at a temperature of 104° to 122° Fahr. The result showed that the only materials applicable for the purification of the gas were sulphuric acid and caustic alkali. Small quantities of tar passing through did not affect the sharpness of the colour change at all. New india-rubber tubing, as has already been pointed out, gives rise to errors. Consequently, the rubber tubing used must be old, and in as short pieces as will suffice.

The author gives tables showing the results of determinations of the naphthalene contained in crude coal gas from horizontal and from vertical retorts. The gas from the horizontal retorts was tested at a point in the foul main of a setting of eight retorts about 40 inches from the hydraulic main. A thermometer was placed in one arm of a T-piece and the gas for testing taken off from another arm. With short rubber connections, the crude gas was led through a purifier in a heated oven; the purifying train consisting of three wash bottles containing dilute sulphuric acid and two wash bottles containing a solution of caustic potash. It was then passed, in the manner already described, into the picric acid solution contained in 100 c.c. flasks, and then through a gas-meter to the suction pump. The vertical retort gas was taken from the gas take-off pipe directly behind the tar-receiver or the hydraulic main of a bed of ten vertical retorts. The rest of the arrangement was the same as for the examination of gas from horizontal retorts. The gas volumes were corrected to normal.

The crude gas from the horizontal retorts contained, when English coal was being carbonized, 350 grains of naphthalene per 100 cubic feet (the temperature of sampling being 129° Fahr.), and the same amount when Upper Silesian coal was being carbonized and the temperature of sampling was 140° Fahr. The vertical retorts, at an average sampling temperature of 160° Fahr. gave gas containing 436 grains of naphthalene per 100 cubic feet. It should be pointed out that the amount of naphthalene in the crude gas is probably somewhat higher than the figures given, because the tar which separates in the purifying liquids certainly contains some naphthalene. The amounts of naphthalene found by the authors may appear to be high; but the figures for the quantity of naphthalene required to saturate gas at the temperatures stated (deduced from determinations of its vapour tension by Messrs. Barker and Allen) show that they are quite probable. Gas, according to their determinations, is saturated at—

| | | | | | | |
|---|---|---|---|---|---|---|
| 131° | Fahr. by | 395 | grains of naphthalene | per | 100 | cubic feet |
| 140° | ,, | 587 | ,, | ,, | ,, | ,, |
| 158° | ,, | 1161 | ,, | ,, | ,, | ,, |

The higher proportion of naphthalene found in the crude gas from vertical retorts must certainly be attributed to the higher temperature at which the sample of gas was drawn off, and is not due to the system itself. Three different descriptions of coal which were carbonized gave practically the same amount of naphthalene in the crude gas.

In order to ascertain how much naphthalene condensed in the mains with vertical retort gas, and how the naphthalene washers worked, determinations of naphthalene were made before and after the washers. The gas before the washers had normally a temperature of only 50° Fahr.; so for these experiments the condenser was bye-passed in order to bring the gas to the washers at a higher temperature. The average temperature before the washer then became 70° Fahr., and the average amount of naphthalene was 11 grains per 100 cubic feet, and after the washer 4·1 grains per 100 cubic feet. At 68° Fahr., the gas would be saturated by 20 grains of naphthalene per 100 cubic feet. The washer was filled with Galician gas-oil, and at the beginning of the tests about 3½ million cubic feet of gas had already passed through it. The washing oil, which originally was free from benzol, contained in the first chamber of the washer after 212,000 cubic feet of gas per diem had been passed through it, 15 per cent. by volume of benzol and 9 per cent. of naphthalene. The results of the investigation show that in the warm season of the year the naphthalene washer may be bye-passed.

## Meeting of the American Commercial Gas Association.

We learn from the "American Gaslight Journal" that considerable interest is being shown throughout the American gas industry in the seventh annual meeting of the National Commercial Gas Association, which is to be held in Denver (Col.) from the 23rd to the 28th of October. The list of papers has been compiled with a view to offering as wide a range of subjects as possible. The following are the titles:

"An Equitable Sliding-Scale for the Sale of Gas." (Editor not selected.)

"Up-to-Date Advertising Methods," by T. R. Elcock, jun., of Philadelphia.

"Illuminating Engineering and its Application to the Gas Industry," by E. L. Elliott, Editor of the "Illuminating Engineer," of New York.

"Exhibit and Description of Model Glass Gas-Works," by A. F. Traver, of Denver.

"The Modern Gas-Fixture," by Charles Ummach, of Chicago.

"The Designing and Construction of Gas Appliances," by R. E. Clark, of Chicago.

"Increased Efficiency in Scientific Office Accounting," by P. R. Jones, of New York.

"Practical Demonstration Work," by Mrs. Anna A. Carroll, of Philadelphia.

The attendance is expected to be exceptionally large; and the success of the exhibition of gas appliances in connection with the meeting is regarded as assured—every space in the hall having been taken.

We have received from the Hon. Secretary (Mr. Ernest Scears) the "Transactions" of the London and Southern District Junior Gas Association for the past session. In addition to the papers and discussions, reprinted from the "JOURNAL," the pamphlet contains a short account of the joint meeting of the English Junior Gas Associations at Birmingham in May last, lists of the officers and members, and the accounts. A portrait of the President (Mr. L. F. Tooth) forms a frontispiece.

## INDIRECT LIGHTING.

The "American Gaslight Journal" for the 11th inst. contains the following article on this subject by Mr. Francis H. Gilfin, of the photometrical laboratory of the United Gas Improvement Company of Philadelphia.

In the development of the illumination of various types of interiors, much stress is now laid on, and attention directed towards, the elimination of bright light-sources from the field of vision, and to the reduction of glare, while at the same time securing a proper distribution of light. But the mere choice of illuminant, its size, and location, should not be the final goal of the illuminating engineer. Efficiency of illumination should not be based solely on lumens per watt or per cubic foot, nor on the basis that makes the investment commercially profitable—the one of dollars and cents per unit of illumination. There is a sounder and more humane basis—that of the ultimate physiological effect, which, as related to the energy used, may be called the practical, or human, efficiency of an illumination scheme. More variables enter into this than as yet can usually be measured by scientific means; for the field is new and but little known. Many of the laws and rules for direct lighting are understood and practised; but the laws governing the ultimate physiological effect are more varied and indefinite. In the physiological field lie the problems of finding what amount of reduction in visual sensibility is due to bright spots of light in the line of vision, and how great is the glare effect caused by a background lighter in colour or brighter in illumination than the object observed.

When there is illumination by direct light, either from a large central source or scattered smaller sources, the first of these problems is rarely absent. The physically measurable amount of light is, in many cases, out of all proportion to the measure of the ability to readily read or distinguish detail. The sources themselves, if not in the direct range of vision, are often so nearly specularly reflected by adjacent objects that the glare effect is only in a measure reduced. Where it is necessary to use a number of sources hung low, enveloping shades or globes of diffusive quality must be used to mitigate the frightful eye strain. Often, where the diffusing medium is made large or selected unusually dense, in the attempt to reduce intrinsic brilliancy, it nearly defeats the purpose of its use by making either an unsightly or a very inefficient installation.

In a large number of cases, the use of a single properly designed indirect or semi-indirect unit would obviate a great deal of the difficulty. Much has been said for and against this system of illumination, with a great deal of truth on both sides. Indirect lighting will never be a panacea to cure all the ills of "glare;" but, if judiciously chosen and properly used, there are many excellent opportunities for its application. Probably the use of a single source, reasonably high, with its light reflected and diffused so that the secondary source, so to speak, becomes the lighting unit, would prevent a great deal of ocular discomfort. In rooms with low ceilings, it has many times been proved in various installations, both of gas and electricity, that this form of illumination has been successful far beyond the expectations of those who devised and installed it. In spite of all that has been said against it, both with, and more often without, proof, its use will increase with a better understanding, especially in the semi-indirect forms of units.

In the use of indirect, or semi-indirect, lighting, the two chief points of discussion are: (1) The loss of perspective, due to the absence of shadows; (2) the so-called "trying effect" on the eye, due to the peculiar method of redirection of the light.

As to the first point, while shadows are not entirely absent, they may be obviated if desired in certain cases where their presence is objectionable, as, for instance, in drafting-rooms. The presence or absence of shadows depends much upon the design of the installation. Where a single indirect unit is used in place of a single direct unit, as in small rooms, the shadows are softened, and the distribution of illumination is made much more uniform. Probably nothing is more trying to the vision than a sharp contrast of light and dark colour, such as deep shadows on a bright sunny day, inasmuch as the persistent straining of the eye to see what lies in the dark places is counteracted by an opposite strain to protect the visual organs against high illumination of bright spots.

Monotony of illumination is sometimes charged to indirect lighting; but this is due not merely to the uniformity of the illumination falling on the surface viewed, but to the uniformity of objects themselves and their almost uniform specific brightness. The eye does not see by a light falling on an object; but, instead, all detail and variation are judged by the effect produced on the retina by the specific brightness, colour, and extent of the object viewed.

It seems unfortunate that many indirect illumination installations have been located in places where simplicity of decoration and multiplicity of similar objects are the rule. Unfortunately, too little attention is paid to the combination of the artistic and the lighting effects. Light ceilings—such as pale yellows, greens, and white—are essential to the efficiency of the system; but walls of similar colour are not essential, especially in a large installation. Even the use of a high dado, of some dark or medium colour, would not seriously affect the efficiency, while it would materially help the æsthetic effect; and this would be true also in direct lighting schemes.

The use of an indirect gas system is still as economical in cost as the most efficient direct electric installation. Generally from indirect gas installations some 50 to 60 lumens per cubic foot may be obtained; while on similar electric tungsten installations from 2·5 to 2·9 lumens per watt may be expected. As the relative selling price of the cubic foot and watt is generally as 10: 1, the indirect gas installation gives double the cost efficiency of the electric one, and is equal to a direct electric installation.

## DETERMINING THE TOTAL SULPHUR IN COAL GAS

Herr M. Dickert, Chemist to the Eschweiler Mining Association, has reported in the "Journal für Gasbeleuchtung" on a new method for the determination of the total sulphur in coal gas. He points out that existing methods fall into two classes—viz.: (1) Those in which a measured quantity of the gas is burned, the products of combustion absorbed, and the sulphuric acid formed determined as barium sulphate or volumetrically; (2) Winkler's method, in which the sulphuretted hydrogen is absorbed by ammoniacal solution of silver nitrate, and the organic sulphur compounds are converted, by passage over heated platinized asbestos, into sulphuretted hydrogen, which is then absorbed in the same way. [The latter method is, of course, very similar to Harcourt's method, in which the sulphuretted hydrogen is absorbed by a syrupy solution of lead acetate; but this method is not mentioned by the author.] The combustion method, however, involves the use of a meter, the water or glycerine in which has to be previously saturated by the gas, while the widely different quantities of precipitate obtained from the sulphuretted hydrogen and from the organic sulphur contained in the same quantity of gas, render Winkler's method troublesome for the determination of the total sulphur, although it answers well for the determination of organic sulphur alone.

The author adds to 10 c.c. of Merck's perhydrol 75 c.c. of a solution of caustic soda of 30° Baumé. A thick crystalline precipitate (which remains suspended in the liquor) is formed, having probably the composition $Na_2O_2+8H_2O$. This substance has a powerful oxidizing action, and converts all the sulphur compounds, except thiophene, into sulphuric acid. The quantity of thiophene in gas is so small that the error due to its non-oxidation is of no importance. The gas to be tested is passed through the liquid, holding the crystals in suspension, contained in a Drehschmidt's washing-bottle. Even if only one bottle is used, the gas can be passed without risk at the rate of 100 litres per hour. After the passage of gas has been stopped, the contents of the bottle are washed into the beaker, acidified with hydrochloric acid, which decomposes the sodium peroxide, and boiled to effect the removal of the resulting hydrogen peroxide. The sulphuric acid is then either precipitated as barium sulphate or determined volumetrically. Results of determinations made in this manner show an agreement within about ± 1 per cent. of the results obtained by Winkler's method.

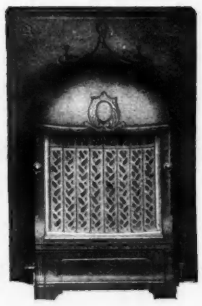
The author claims for the method that it occupies less time than the older methods, does not entail the combustion of the gas—and therefore may be carried out in any place on a gas-works—and may be applied, by the use of an aspirator, to apparatus in which the gas is under a vacuum.

### Photometric Tests at the Imperial Physical Technical Institute at Charlottenburg in 1910.

The report of work done at the Physical Technical "Reichsanstalt" last year, as given in the "Zeitschrift für Instrumentenkunde," states that 127 Hefner lamps were certified, the majority of which were fitted with the optical flame measurer. This makes a total of 1832 of these lamps certified by the Laboratory since the examination of them was undertaken in the year 1893. There were also examined 190 carbon filament and 375 metallic filament electric lamps, all intended to serve as standards for photometrical purposes. Other electric lamps were tested for durability, as were also a number of incandescent gas burners and mantles. Tests were also made with a number of glass chimneys for incandescent gas-burners; the object being to compare the effect of clear glass chimneys with those of chimneys of Euphos glass, having a greenish tint. The Euphos chimney proved to give a 6 per cent. lower average horizontal illuminating power than a clear glass chimney. It is reported also that the British Committee of the International Electro-Technical Committee have suspended their endeavours to introduce the new so-called "international" candle as a unit of light. The Austrian technical bodies have decided to retain the Hefner lamp as a standard of light for the present, and to remit the consideration of the question to the next meeting of the International Photometric Committee—*i.e.*, the meeting which was held at Zürich in July last.

**A Gas-Engine Handbook.**—We have received from Messrs. Crosby Lockwood and Son "A Handbook on the Gas-Engine." It is a practical treatise on internal combustion engines, written for the use of engine builders, engineers, and others, by Herr Herman Haeder, of Wiesbaden. The work just published (of which a more extended notice will appear later) is a translation from the German by Mr. W. M. Huskisson, who has edited the text, and added numerous useful tables and other matter. The price of the book is 18s. net.

# Davis's



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*Chapter 3.*

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*(To be continued next week.)*

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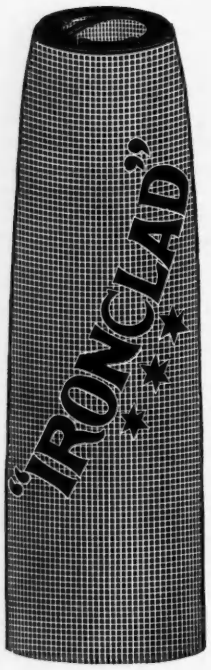


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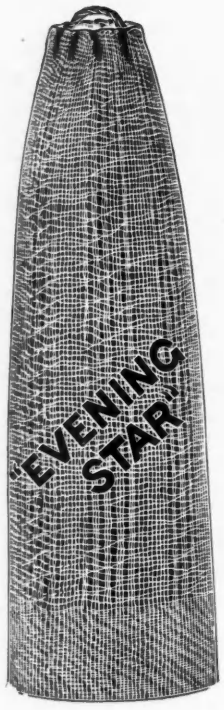


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## THE CALIBRATION OF HIGH-TEMPERATURE THERMOMETERS.

A paper by Dr. Arthur L. Day, Director of the Geophysical Laboratory of the Carnegie Institution of Washington, on "Recent Advances in High-Temperature Gas Thermometry," which was read before a meeting of the Faraday Society a short time ago, describes the progress made in recent years in extending the range of the air or gas thermometer to temperatures at which it overlaps the region in which radiation pyrometers are available. The calibration of radiation and thermoelectric pyrometers has by these advances been rendered much more exact and trustworthy. Incidentally also, a number of melting points of importance have been determined with greater precision than hitherto. The following is a summary of the contents of Dr. Day's paper.

Relative measurements of temperature can be made with comparative ease with the thermo-element and the resistance thermometer or the radiation pyrometer; but the measurements so made are dependent absolutely upon fundamental measurements with the gas thermometer for their evaluation in terms of the generally accepted Centigrade degree. Until recently, however, the range of the gas thermometer was limited upwards at about 1150° C., and radiation pyrometers are ineffective below 900° C.; so that it was only in the interval between 900° and 1150° that comparison was possible for the purpose of calibrating the scale of the radiation instrument. The scale was commonly extrapolated much beyond 1150°; but such a procedure was obviously very uncertain. It was therefore eminently desirable that the scope of the gas thermometer should be extended 200° or 300° farther, so that the radiation pyrometer might be compared and accurately calibrated over a wider range. The thermo-element overlaps both the gas thermometer and radiation pyrometer. It likewise depends for its calibration directly on the gas-thermometer scale, and there is uncertainty about its extrapolation beyond 1150° C.

The author refers to the attempts made in the present century to measure temperatures above 1000° C. with the gas thermometer. There have been four such attempts—viz.: (1) By J. A. Harker at the National Physical Laboratory in 1904, in which the thermometer used had a porcelain bulb, and was filled with nitrogen. Very little new information resulted from this investigation. (2) By Jacquerod and Perrot in 1905, with a bulb of "quartz glass," and with, successively, nitrogen, oxygen, air, carbon monoxide, and carbon dioxide as the contained gases. They determined thus the melting point of pure gold, but made no effort to extend the measurements above 1150° C., and indeed the silica bulb would have precluded any considerable extension in this direction. (3) By Holborn and Valentine in 1906, using a bulb of platinum containing 20 per cent. of iridium, and a bulb of pure iridium, both with nitrogen as the expanding gas. With the pure iridium bulb, temperatures of nearly 1700° C. were several times reached. (4) By Day and Clement in 1908, and Day and Sosman in 1910, using bulbs of platinum containing 10 per cent. of iridium and 20 per cent. of rhodium respectively, with nitrogen as the expanding gas.

The author proceeds to discuss the conditions which were observed in the last-named series of investigations. Nitrogen was chosen as the expanding gas because it may be used up to 1600° C. without any appearance of irregularity in its expansion or evidence of dissociation. Porcelain bulbs were avoided, because porcelain cannot hold the expanding gas without some absorption or loss, and it is not absolutely uniform in its own expansion and contraction. A bulb of platinum containing 20 per cent. of rhodium was ultimately selected for use at the Geophysical Laboratory in preference to a platinum iridium alloy, because the thermoelements are liable to contamination if exposed to the vapour of iridium. The furnace was electrically heated, and the bulb and heating coils were enclosed in an air-tight bomb, by the use of which the gas pressure outside the bulb could be controlled and kept equal to the pressure of the expanding gas within. This avoided risk of diffusion of the gas through the wall of the bulb, and relieved the bulb from mechanical strain at the high temperatures at which the metal is soft.

The temperature differences in different parts of the bulb were diminished in these researches to about 2° in the region 1500° to 1600° C. The manometer was of the open U-tube type, the capillary connection between it and the bulb being reduced in capacity as far as possible. It is not, however, practicable to restrict the diameter of the connecting capillary in the portions which are heated below 0·8 mm, because the increased viscosity of the gas at high temperatures would otherwise cause equilibrium to be established very slowly. The auxiliary thermo-elements placed in the furnace with the bulb were used afterwards for the determination of a series of standard fixed temperatures, such as the melting points of metals, minerals, or salts. The melting temperature of three or four of these substances thus determined may now be used for the calibration of other thermo-elements and for checking the calibration of existing thermo-elements, which may have been exposed in use to contamination from metallic vapours. The following are a few of the standard melting points, &c., found by Day and Sosman, placed side by side with the standard melting points published by the Reichsanstalt in 1900, which are those now generally used:

*Table of Melting Point Determinations.*

| Substance. | Atmosphere. | Crucible. | Melting and Freezing Point Temperature (Day and Sosman). (1910) | Reichsanstalt Scale. (1900) |
|---|---|---|---|---|
| Cadmium | Air | Graphite | 320·0° C. ± 0·3 | 321·7° C. |
| Zinc | ,, | ,, | 418·2° ,, ± 0·3 | 419·0° ,, |
| Antimony | Carbon monoxide | ,, | 629·2° ,, ± 0·5 | 630·6° ,, |
| Aluminium | ,, ,, | ,, | 658·0° ,, ± 0·6* | 657·0° ,, |
| Silver | ,, ,, | ,, | 960·0° ,, ± 0·7 | 961·5° ,, |
| Gold | ,, ,, | ,, | 1062·4° ,, ± 0·8 | 1064·0° ,, |
| Copper | ,, ,, | ,, | 1082·6° ,, ± 0·8 | 1084·1° ,, |
| Diopside | Air | Platinum | 1391·2° ,, ± 1·5† | .. |
| Nickel | Hydrogen and nitrogen | Magnesia and magnesium | 1452·3° ,, ± 2·0 | .. |
| Cobalt | ,, ,, | Magnesia | 1489·8° ,, ± 2·0 | .. |
| Palladium | Air | Pure Magnesia | 1549·2° ,, ± 2·0 | 1575 0° ,, |
| Anorthite | ,, | Platinum | 1549·5° ,, ± 2·0 | .. |
| Platinum | ,, | .. | 1755‡ 1752§ ,, ± 5·0† | .. |

* Freezing point. † Melting point. ‡ Extrapolation optical. § Extrapolation thermo-electric.

The estimates given of the melting point of platinum were obtained: (1) By adding the difference observed by radiation methods between the melting points of palladium and platinum to the melting point of palladium as determined by the gas thermometer; (2) by extrapolating the curve of thermal electromotive force from the palladium melting point to the point at which the platinum wire of the thermo-element melts. The two estimates—viz., 1755° and 1752° C.—are in excellent agreement, and are 50° above the previously accepted temperatures ascertained by extrapolating the parabolic curve of electromotive forces from the temperature of 1150° C. The researches carried out at the Geophysical Laboratory at Washington have opened the way for direct and accurate calibration of radiation pyrometers throughout the range 900° to 1550° C., and afford a more certain basis for extrapolation to higher temperatures.

## STANDARDS OF LIGHT & THEIR APPLICATIONS.

Dealing with this subject in a recent number of "Engineering Record," a writer points out that, considering the enormous amount of money that is annually spent for public and private lighting, the standards and methods by which light is evaluated have until recently been in a shockingly crude condition. The fundamental trouble with getting a standard of light is the difficulty of finding any light-moving body which can be trusted to operate uniformly, and is at the same time a thing which can be reproduced with concordant results. The practical standards which have been employed are flames from the combustion of some substance of definite composition burning under carefully specified conditions. The trouble began with the candle, of which several kinds, specified with more or less lack of precision, have been employed as legal and official standards of light. Three other flame standards—the Carcel, the Hefner, the Pentane—have been, and are, widely used; and all of them have proved much more reliable than any candle. They are frankly empirical; but the labour of many years has enabled them to be evaluated with respect to each other with a high degree of precision. The world's measurements of light are, therefore, practically tied up to these three lamps.

The present standard of luminous intensity is the so-called international candle, which is the formally recognized standard in the British Empire, France, and the United States. It was the result of a call for international action on the part of the Illuminating Engineering Society, followed by the active co-operation of the national standards laboratories of the three countries concerned. The value set for the international candle was practically a mean between determinations based on the intercomparison of the Pentane, Carcel, and Hefner lamps. Its general acceptance involved some slight changes in the values heretofore assumed. But these have been fully accepted by the technical bodies representing the lighting interests of all three countries, and by the Government service as well; so that now a candle power means

precisely and identically the same thing in each of the countries concerned, and every lamp measured—whether gas, oil, or electric—is measured in terms of the international candle.

Whether anything better than the international candle can be devised for a standard, remains to be seen. An extremely interesting suggestion was recently made by Dr. Ives, pointing to a standard of light which could be rigorously evaluated by a measurement of energy, such as could be made by a thermopile or a bolometer. His suggestion would call for a definite amount of energy transformed into light at the maximum efficiency of transformation—a condition which he suggests may be practically met by utilizing the green line of the mercury vapour lamp, which happens to lie practically at the point of maximum luminous efficiency in the spectrum. The writer of the article from which the preceding remarks have been taken says the question whether this standard could be made accurately reproducible will require much investigation to determine; but the proposition is a very promising one, as reducing the measurement of light to a strict measurement of energy, which can be made with a very high degree of precision. But, given the international candle, one has at least a very satisfactory point from which to start in the measurement of commercial illuminants. Here trouble begins, not so much in lack of precision in strictly photometric measurements, as in the lack of any general agreement as to how these shall be applied.

The writer considers there is acute need for a general convention on the rating of practical illuminants similar to that which has actually been carried out in the establishment of a luminous standard. This reform unfortunately is, he says, much harder to effect than that already accomplished, since it interferes with "those comfortable measurements which tend to give an exaggerated notion of the value of the lights to which they are applied." Nevertheless, the thing ought to be done, even though it upsets some amiable fictions. The old "2000-candle power" arc lamp rating has been pretty successfully relegated to the waste-paper basket; and it ought to be followed by all the other hypothetical ratings which have succeeded it. This, however, will take time; and it is at least a subject for congratulation that there is now a definite standard to which may be referred any measurements which have been finally settled upon as just.

## COEFFICIENT OF EXPANSION OF TAR.

The current number of the "Journal of the Franklin Institute" contains an article on the above subject written by Mr. J. Morris Weiss, of the Barrett Manufacturing Company. The author points out that coal tar and other tars are commercially bought and sold by the gallon; and as temperature plays an important part in liquid volume measurements, it is essential to know the effect of changes of temperature on volume. This knowledge is summed up in the coefficient of expansion. Coal tar from different sources varies considerably in composition, and hence also in its expansion coefficient.

In the paper are presented tests of various kinds of tar, along with their coefficients of expansion, as determined in the laboratory. The method of procedure was quite simple. The specific gravity of the tar was determined at various temperatures, compared with water at the same temperature. A specific gravity bottle of 50 c.c. capacity, the weight and water content of which at various temperatures were known, was filled three-quarters full of tar and weighed. Then water was added, adjusted to the temperature desired, and weighed.

Let $a$ = weight of bottle; $b$ = weight of bottle + water at $t°$; $c$ = weight of bottle + tar; and $d$ = weight of bottle + tar + water at $t°$. The specific gravity was—

$$t°/t° = \frac{c-a}{(b-a)-(d-a)} = \frac{c-a}{(b+c)-(a+d)}$$

From this figure, the density, or a direct mass and volume relation, could be readily obtained by multiplying the specific gravity by the density of water at that temperature.

In the accompanying table are shown a number of dry tars thus tested, giving free carbon, specific gravity, and coefficient of expansion. To summarize: The coefficient of expansion of tar is defined as the amount one unit volume of tar will expand or contract for 1° Fahr.; and the coefficient is practically constant for any particular tar in ordinary ranges of temperature. The coefficients of expansion of a number of tars are given.

| Kind of Tar. | Free Carbon, per Cent. | Specific Gravity at 60° Fahr. | Coefficient of Expansion for ° Fahr. |
|---|---|---|---|
| Water gas | 1·04 | 1·073 | ·0003750 |
| ,, ,, | 1·08 | 1·090 | ·0003550 |
| Gas-works coal | 16·67 | 1·203 | ·0003125 |
| ,, ,, | 18·53 | 1·205 | ·0003125 |
| ,, ,, | 27·50 | 1·249 | ·0003100 |
| ,, ,, | 33·17 | 1·296 | ·0002700 |
| Coke-oven coal | 8·97 | 1·185 | ·0003375 |
| ,, ,, | 5·27 | 1·193 | ·0003350 |
| ,, ,, | 4·04 | 1·178 | ·0003300 |
| ,, ,, | 6·72 | 1·195 | ·0003250 |
| ,, ,, | 6·65 | 1·197 | ·0003125 |
| ,, ,, | 9·10 | 1·203 | ·0003125 |
| ,, ,, | 19·06 | 1·258 | ·0003075 |
| ,, ,, | 15·02 | 1·231 | ·0003050 |

## ELECTRICITY v. GAS FOR HEATING AND COOKING

In previous issues of the "JOURNAL," reference has been made to the course of Cantor Lectures, on "The Applications of Electric Heating," delivered at the Royal Society of Arts early in the year by Dr. J. A. Fleming, F.R.S., Pender Professor of Electrical Engineering in the University of London. The lectures have been published in the Society's "Journal," a recent number of which contained the concluding lecture, in which the domestic applications of electric heating are dealt with. As these are compared with similar operations performed by gas, some extracts from the lecture may be of interest.

Great as may be the present consumption of electric energy for private electric lighting, many competent judges are of opinion that a very large additional field for its use exists in connection with the generation of heat for domestic purposes. At the same time, it is clear that this widely extended use of electric energy in home life has not yet arrived in any large degree; and it will be desirable, therefore, to examine the reasons for this, and discuss the retarding causes now in operation. Apart from minor uses, which are not at present important, and leaving out of account the employment of electric energy for motive power, the demand for heat in our houses arises from the necessity for water heating, air heating, and food heating. We have to consider the nature of the appliances, their durability and prime cost, and the cost of working; also their economy and advantages as drawbacks relatively to other methods of heating.

It will be well to describe first those operations and appliances which can be easily and accurately brought into comparison when using different methods of heating. While leaving certain general questions for discussion later, we may say at the present moment that one cause retarding the domestic use of electric energy for heating purposes is ignorance of the methods of usage and of the cost. Hence any information which tends to dissipate this ignorance will unquestionably assist the experimental or tentative adoption of these newer methods of heating. Another and most influential cause is that houses are not yet wired properly for the supply of electric-heating current in our rooms.

Let us consider some of the facts in connection with water heating, because the supply of hot water, in small or large quantities, is a prime necessity in modern domestic life. Consider the energy required to raise any mass of water from the ordinary air temperature—say, 60° Fahr.—just up to the boiling-point, or 212° Fahr. This involves raising it through 152° Fahr. And since one pint of water weighs 1·25 lbs. and one gallon 10 lbs., it is clear that to raise one pint of water just up to the boiling-point requires 190 B.Th.U., and one gallon requires 1520 B.Th.U. to be imparted to the water. Since 1 B.Th.U. is equal to 0·294 watt-hours, it is seen at once that the energy required to raise one pint of water from 60° to 212° is 55 watt-hours; and to raise one gallon through the same temperature requires 440 watt-hours.

As all heat can be reckoned in energy units, and since electric energy is supplied to our houses at so much per kelvin, or Board of Trade unit, and since one kelvin equals 1000 watt-hours, it is obviously an advantage to measure each operation of heating, whether of air, water, or food, by the energy in kelvins required to produce the desired effect. Hence to heat the gallon of water from 60° to 212° requires 0·44 kelvin. Otherwise, 2·27 gallons of water could be raised from 60° to 212° by imparting to it energy equal to one kelvin. Electric energy is supplied in our houses by the corporations or electric supply companies at so much per kelvin—generally 4d. to 6d. for lighting, and 1d. to 1½d., or in some cases less, for heating. Hence, if we reckon our energy consumption in kelvins, it gives us at once the cost in pence, assuming it is sold at 1d. per unit. The heating of the gallon of water up to boiling-point requires 0·44 kelvin, as far as the heating of the water itself is concerned. Again, to provide 10 gallons of hot water at 110° raised from 60° for a bath requires 5000 B.Th.U. to be given to the water, equivalent to an expenditure of 1470 watt-hours, or 1·47 kelvins.

The above figures for the energy absorption do not, however, give us the cost of the operation, because, owing to thermal losses, more energy has to be employed than that represented by the temperature rise of the known weight of water. The user has to pay for these losses. Hence we cannot give an answer to the question as to the cost of the electric heating, even when the price at which electric energy is supplied is known, until we have ascertained the efficiency of the various types of electric kettles, boilers, and water-heaters employed. By their efficiency, we mean the ratio between the energy actually employed in heating the water to the total amount given to the heater; this ratio being expressed as a percentage. The simplest method of heating water electrically, and one which requires the least alteration in ordinary water-supply arrangements, is to use an immersion heater. This consists of some kind of high-resistance substance—often a wire coiled compactly, and enclosed in a water-tight tube, the ends being brought out above the water surface. When a current is sent through the wire, it is heated and imparts its heat to the water. [The lecturer here described in detail various water-heating appliances.]

This leads us to notice the various types of electric kettle and water-boiler for cooking and other small purposes. We may divide existing types of apparatus into two classes. There is first

the type of kettle or boiler which contains in itself a heating resistance of some kind, and therefore is a special article. Yet another mode of electric heating for water-boiling or cookery is to employ an ordinary kettle or saucepan over an electric hot-plate or incandescent radiator. But the class of kettles which are most efficient with gas-rings are not most efficient with electric hot plates.

In the case of ordinary coal gas employed as a heating agent with the usual gas-rings, we may reckon that each cubic foot of London gas at 60° Fahr. and 30 inches barometer, has in it potential energy available for heating equal to about 550 B.Th.U. This calorific capacity varies somewhat from day to day according to the chemical constituents of the gas. Since 1 B.Th.U. equals 0·294 watt-hour, we may say that the intrinsic or gross calorific capacity of London gas is about 162 watt-hours per cubic foot, or 162 kelvins per 1000 cubic feet. The question then arises: How much of this 162 kelvins can we utilize in water-heating? I find much depends upon the kettle and the gas-ring. For each kettle there is an appropriate size of gas-ring and a certain rate of supply of gas, which gives the best efficiency. Taking an enamel iron kettle holding one quart, and putting it over a large gas-ring, it was found that it required 0·9 cubic foot to raise one pint of water to the boil. This means that energy equal to 146 watt-hours was supplied as gas burnt to impart 55 watt-hours to the water. The efficiency, therefore, is only 34 per cent. Using a smaller gas-ring, the gas burnt was only 0·67 cubic foot for the same duty—equivalent to an efficiency of 53 per cent. If a bright tin kettle was employed, the consumption was 0·61 cubic foot—an efficiency of 58 per cent.; and if a "kwik" kettle, or one having water-tubes in the base, was used, the gas consumption fell to 0·55 cubic foot, and the efficiency rose to 61 per cent. Using three pints of water in a bright tin saucepan over a small gas-ring gave a consumption of 0·62 cubic foot per pint, and an efficiency of 58 per cent.

It is clear, therefore, that when using an ordinary tin or iron kettle over a suitable gas-ring, we cannot obtain a much higher efficiency than 60 per cent. On the other hand, with the electric kettles we can obtain an efficiency of 80 per cent. or more. The ultimate question, however, is one of cost. If electrical energy is supplied at 1d. per unit, then the best electric kettle will take 60 watt-hours to boil the pint of water, costing 0·06d. The best ordinary kettle and gas-ring takes 0·55 cubic foot of gas, which, at 2s. 9d. per 1000, will cost 0·018d. Accordingly, for the small operation of boiling a pint of water, the gas has the advantage in mere cost, but many disadvantages from other points of view. If, however, we take into account the fact that gas-burners in the hands of domestics are nearly always lit before they are wanted, and left burning after they have been used, the practical ratio between the cost of small water-boiling by gas at 2s. 9d. per 1000 cubic feet and electric energy at 1d. per unit is not nearly so large as 1:3. It is more like 1:2, or even 1:1. As regards larger quantities, it is easy to show that to provide 10 gallons of hot water at 110° for a bath, raising it from 60°, requires the expenditure of 2 kelvins. This, at 1d. per electrical unit, costs 2d. My experience is that to do it by gas requires 30 to 40 cubic feet of London gas, costing 1d. to 1⅓d. It must be remembered, however, that each cubic foot of gas requires, roughly speaking, two cubic feet of air to burn it, and that the products of combustion and imperfectly burnt gas have to be got rid of. This renders the use of gas-geysers, gas-kitcheners, and gas-heaters generally, except on a very small scale, impossible without adequate ventilation, and therefore the comparison of the two agencies merely on the basis of cost of gas and of electric energy is unfair.

As a final result, we may say that water heating by electric current is not only practical on a large or a small scale, but that, even at the present cost of electric energy, it is not at much disadvantage compared with gas at 2s. 6d. per 1000 cubic feet, while if electric energy can be generally supplied at a cost of ½d. per unit for domestic heating, as it is in some places, the advantages will be all on the side of the electric heater. Furthermore, we may say that in the public supply of hot water for domestic purposes there is a source of revenue for electric supply stations which has hardly yet been touched.

We have in the next place to consider electric heating for other culinary purposes. A large part of the operation of cooking consists in exposing the edible material to such a temperature that, if of animal nature, the albumen in the flesh is coagulated, but not at such a temperature as to render it insoluble in the gastric juices. Also other operations involve the partial conversion of starches into dextrine, as well as the softening of animal or vegetable tissues by heat. The heat for the purpose must be capable of ready variation over a range of temperature from 100° to 500° Fahr. In many operations, such as baking meat, the temperature has to be high at first and somewhat reduced later; but every oven should be capable of attaining and keeping a temperature of 400°.

The electric ovens in use may be of two types: One which consists of an iron chamber heavily insulated with non-conducting material, in the walls of which coils of wire are embedded, which are heated by the current sent through them, the other being nothing more than a light sheet-metal box (highly polished on the outside to prevent loss by radiation) placed over a hot plate in which heat is generated by passing a current through resistances. For frying or grilling, we have the option of using the type of electric saucepans or grillers in which heating wires of a special alloy are embedded in enamel; this enamel being so composed that it has the same coefficient of expansion as the wire, and does not, therefore, tend to break away from the wire when hot. Or we may use ordinary saucepans or grillers on an electric radiator in which some resistance material is heated to incandescence—this radiator taking the place of the coal-fire. Broadly speaking, we may say that, when we use the special electrical vessel with embedded resistances, we can obtain the highest energy efficiency, because we can most perfectly insulate it, and prevent the heat from escaping in directions where it does no work. On the other hand, such vessels are bound to be more expensive, heavier, and more fragile, or easily injured, than the ordinary culinary vessels. Hence they have less durability in ordinary domestic use. Those systems in which an electric heater or radiator is employed to take the place of the ordinary fire or gas-ring, and on which an ordinary saucepan, kettle, or a similar class of vessel, is used, may give less efficiency, in an energy sense, because there may be a greater wasteful loss of heat.

The cost of cooking, apart from the cost of materials and wages, is made up of the cost of energy or fuel and of the apparatus distributed over its useful life. Thus, if an electric kettle costs 15s. to begin with, and has to be repaired even only once a year at a cost of 5s. each time, and lasts (say) three years, we should have to consider the cost of the appliance as 10s. per annum. On the other hand, if an ordinary gas-ring and enamel iron kettle cost 6s. to begin with, and need no repairs, but last six years, the cost of the apparatus is 1s. per annum. Hence the initial outlay and the cost of repairs and life of the appliance are very important elements, and have to be taken into consideration as well as the cost of electric energy as compared with gas or coal. The electric oven has the great advantage over the gas oven that the interior is free from the products of combustion.

There is, however, a large field for improvement still open in these appliances. As regards electric cooking apparatus generally, the following qualities are essential. Anything required in ordinary domestic use has to be strong, simple, and quite easily managed; and in the present state of the domestic labour market, the less cleaning required the better. Again, the advantages of low voltage are supreme in the case of electric cooking. It is nothing short of a crime to place in the hands of ordinary domestic servants electric cooking apparatus worked at 220 volts off one side of a 440-volt service. In the case of cooking by electricity, just as in the case of lighting by metallic filament lamps, the advantages are all on the side of alternating current supply, as then the voltage can be reduced to 50 or 25 volts, and be made safe in the hands of a child. The chief fault of much of the present electric cooking apparatus is that it does not supply a sufficiently high temperature or furnish heat quickly enough. In cooking, it is necessary to be able to command high temperatures quickly for a short time. This is why such a simple operation as making a piece of toast is better carried out by an ordinary coal-fire than by most of the electric toasters. It is necessary to be able to force or delay the process of heating at pleasure; and the present electric cooking appliances are deficient in this respect. Furthermore, many of those in the market are either too costly or too flimsy. Cost, however, is a matter of production.

We are at present in the condition, as regards electric heating, in which we were in 1883 or 1884 with regard to electric lighting. The price of the electric energy cannot be reduced until the demand is greater and the cost factor improved. The demand cannot arrive until the facilities for using the current are given; and it will therefore only at first appeal to those who can make the necessary expenditure in wiring. What is now chiefly required as a preliminary condition is that the ordinary speculative builder, when erecting houses, shall provide separate and proper electric wires for heating circuits. Experience, however, shows that electric cooking is on a different basis, as regards cost, from electric water heating. When once an oven has been brought up to the cooking temperature, the only reason for supplying more energy is to make up the losses by radiation and convection. It is possible to reduce these losses to a very small amount, and yet to maintain the required cooking temperature. In electric cooking, the food is not contaminated with the products of combustion. Ovens can have a more uniform temperature in them than when heated by gas or coal; and also food, such as meat, wastes less or loses less in cooking by electricity than by gas, and has also a better flavour. As regards the cost of it, a rough-and-ready rule appears to be that when the cooking of a household is conducted entirely by electricity, it requires one unit (one kelvin) per day per person, *plus* one or two units for energy losses. Thus six kelvins per day should do the cooking for four persons, taking the usual three meals, provided they are not elaborate.

We have, in the third place, to consider the question of air-heating or house-warming by electric heating. In addition to food required for the sake of maintaining animal heat, we find ourselves under the necessity of maintaining a certain internal air temperature if we are to be thoroughly comfortable; and the limits of this are rather narrow. We may say that 60° to 65° is the normal healthy room air temperature. If it falls below 45° or 50°, we feel it cold; and if it rises to 70° or 75°, we feel it to be warm. Hence, for comfort and health, the air in which we live should be maintained as far as possible at 60°. But more. We are acutely sensitive to the hygrometric condition of the air, or to the percentage of water vapour in it. If it is very dry, we experience sensations of enervation, and also if very moist. About 10 litres of water vapour per cubic metre of air, or about 1 per cent. of water vapour by volume in the air, appears to be a comfortable

amount. Also health and comfort are greatly determined by the organic matter in the air. The ordinary methods of house heating are acknowledged to be extremely unscientific and wasteful; yet nevertheless there is something to be said in favour of them, as they at least produce some degree of ventilation necessary to renew the air in our rooms and carry away the products of organic contamination. And it is not only necessary that the temperature and moisture should be kept within limits, but equally so that the organic contents of the air and its carbonic acid contamination should be kept below a certain amount. We all know that a room without a fireplace and chimney is never so healthy as one in which there is a fireplace. We shall not be able to afford time to discuss the advantages or disadvantages of heating by coal-fires, anthracite-stoves, gas-fires, or hot-air heating, but must confine ourselves to the problem of electric room heating. There are two systems of doing this—one by luminous radiators and the other by non-luminous heaters or convectors. Lately, however, these systems have been combined.

It is important, as a preliminary to further discussion, to consider the amount of heat required to raise a given volume of air to a given temperature. At ordinary temperature and pressure, 12·35 cubic feet of air weigh 1 lb. Hence 1000 cubic feet of air weigh nearly 80 lbs. The specific heat of air is ·2375. Hence to raise the temperature of 1000 cubic feet of air 1° Fahr. requires 80 × ·2375 B.Th.U., or 19·24 B.Th.U. = 5·65 watt-hours. Supposing the air is raised from 32° to 65° Fahr., or through 33°, then to raise 1000 cubic feet of air from 32° to 65° requires 186·45 watt-hours, or 0·186 kelvin, or roughly one-fifth of a Board of Trade unit of electric energy. Supposing the room to be heated is one of about 2500 cubic feet. Then to heat the air in the room from the freezing-point to a comfortable temperature of 65° would theoretically require only 0·5 kelvin. The air has, however, to be renewed at least twice an hour for the removal of carbonic acid and organic products; and hence it would require at least one kelvin even for the mere air-heating. Practically, it would require far more than this; and even a good deal more if the doors and windows are closed and there is no renewal of the air. The reason for this is that the walls, window, floor, and ceiling absorb heat at a very considerable rate; and as it is not possible to raise their temperature sensibly, we may say that heating the air of a room is an operation like pouring water into a leaky vessel, or trying to fill a bath when the waste-plug is open. In this last case, in order to raise the level of the water at all, we must let in the water faster than it runs out; and the depth to which we can fill the bath depends on the ratio of the rates of inflow and outflow. So in the case of room heating, the demand for heat does not arise nearly so much from the heat capacity of the air itself as from the heat escape through the walls and windows.

If our houses were only constructed on scientific principles so as to be heat-tight, or at least less diathermous than they are at present, we should be astonished to find how little energy expenditure would keep us warm. The house of the future will have double walls, double windows, no chimneys, ventilation by electric fans, the incoming air heated electrically, and all the cooking and warming provided without any form of combustion or necessity for chimneys requiring constant sweeping. As constructed at present, however, experience shows that a rate of supply of electric energy equal to one watt for every cubic foot of air in a room will in general maintain it at a comfortable temperature in winter. Hence, in the case of the room of 2500 cubic feet capacity, it would require at least 2 kelvins per hour, or 2 kilowatts, to be supplied to it to keep it warm in winter by electric heating. This is equivalent to a complete renewal of the air every 2½ hours. Since electric heating does not vitiate the air, and does not require any chimney, the ideal method of heating and ventilating a room would be to exhaust or draw out the vitiated air, and heat the incoming air at the point where it is drawn in. It is clear, however, that nothing could be more unscientific than the ordinary system of room warming by gas or coal fires. The greater part of the heat goes up the chimney with the products of combustion. The incoming air is not warmed, but makes draughts along the floor; and the utmost that can be said is that the fire looks cheerful and ventilates the room.

Experience shows that a gas-stove, as usually employed, suitable for warming a room of 2000 to 2500 cubic feet capacity, takes 50 cubic feet of gas per hour. This amount of gas contains about 25,000 B.Th.U. total calorific energy, equivalent to about 8 kelvins. Thus, since about 2 kelvins per hour supplied to electric radiators will warm the room at the same rate, the average gas-fire may be sending up the chimney energy equal to 6 kelvins per hour. Thus, 75 per cent. of the available heat may pass up the chimney with the products of combustion, and 100 cubic feet of fresh air has to be drawn in merely to burn the gas. As only 0·5 kelvin is required to heat the air itself from 32° to 65°, the true efficiency of the gas-fire can only be determined when we know how many hours' burning it would require to bring the air in the room up to 65°, and keep it at this temperature. Electric room heating may be conducted by several kinds of heater—viz., the luminous radiator, the non-luminous radiator or convector, the electroyl or hot oil-radiator, and the combined luminous and convector heater. [The lecturer described these appliances.]

From a sanitary point of view, electric heating is everything that can be desired. The glow-lamp heaters are suitable for occasional use, but need outlay on lamp or spiral renewals. An excellent plan is to combine the luminous and the non-luminous systems, ventilating the room by an electric fan, exhausting the air from the room at a point rather above the middle of the room, and then arranging three non-luminous heaters round the room, and a fourth luminous one for appearance.

As regards cost, I have made some experiments in my own home on the relative cost of coal, gas, and electricity as heating agents. Taking a room about 14 ft. × 20 ft. × 9 ft., having about 2500 cubic feet capacity, I find that if a coal-fire is kept running all day—say, for 12 or 14 hours—it will use about 40 lbs. of coal per day, or one-eighth of a ton per week. At 28s. per ton, this will cost 3s. 6d. per week, or ½d. per hour for coal only, exclusive of wood or lighters, labour, and chimney sweeping. I find that a gas-fire of a good kind suitable for warming such a room takes 45 cubic feet per hour, and at 2s. 6d. per 1000 cubic feet, the cost is 1½d. per hour, or 7s. per week, running eight hours a day. As a matter of fact, such a gas-fire will really cost somewhat less, because in the generality of cases it can be put out for some hours in the day without inconvenience, and lit again at a moment's notice. To do the same heating by an electric convector with electric energy supplied at 1d. per kelvin will cost about 2d. per hour, or about 9s. per week. Hence, even at 1d. per unit, it is not to be denied that electric room heating costs more than coal but not much more than gas; while it has unquestionable advantages over either.

When a sufficient demand springs up for electric energy for heating to enable the price to be lowered to ½d. per kelvin, it will prove a most formidable competitor to each of the older forms of heating, and in time will no doubt replace them both. Even now there is a large demand for electric radiators and convectors for heating ships' cabins and saloons, motor-houses, small offices, bedrooms, and any places where flame-heating cannot be used on account of danger of explosions. The present hindrances to its progress are, first, the want of proper electric heating wires in private houses. Electric heating circuits must be run to convenient points on the wainscot of kitchens, sitting-rooms, and bedrooms, with appropriately placed fuses and switches. Then, in the next place, there must be a wider diffusion of the knowledge of how to use electric heating to the best advantages. Cheaper and more substantial appliances, both for cooking and room heating, must be placed on the market. Lastly, the price per unit for electric energy for heating must come down to ½d. Even at the present rates, the advantages of electric cooking have only to be more widely known to be better appreciated; and it is not necessary to wait for the perfection of electric room-heating before adopting it for cooking. The chief difficulty at present is the wiring problem, as well as the absence of experience. But these obstacles can only be removed by degrees. The demand makes the supply; but the supply can only come from demand. Nevertheless, I have the firmest faith in the future of electric heating, not merely in the workshop and factory, in large metallurgical operations or mechanical arts, but in its home application in cooking, water-heating, and room-warming, giving us not only light and power, but the most perfect, cleanly, and convenient source of heat to meet all the demands of domestic life, and serving to reduce the difficulties of monotonous but necessary domestic labours, which are not likely to be very greatly diminished in any other way.

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**Institution of Municipal Engineers.**—A joint meeting of the Yorkshire and Northern Districts of the Institution will be held in Leeds on Saturday, the 7th prox. The programme prepared for the occasion includes visits to the Headingley pumping-station (electric) and the new filter-beds of the Leeds Corporation.

**Heat Transfer Through Furnace Walls.**—This subject has been investigated by Messrs. W. T. Ray and H. Kreisinger, of the United States Bureau of Mines. They used a special furnace 43 ft. 4 in. long over all, 3 feet wide, and 3 ft. 3 in. high, about 5 feet of the length being occupied by a mechanical stoker. A 2-inch air space separated the inner and outer walls, and a 1-inch layer of asbestos was used between the inner and outer arch rings. Temperature measurements were made at many places by thermo-couples. The results are given in a bulletin issued by the bureau, and from them the authors conclude that, so far as loss of heat is concerned, a solid wall is preferable to a hollow one of the same total thickness, particularly if the air space is near the interior surface.

**Gas Association Work Across the Atlantic.**—According to an article communicated to the "American Gaslight Journal" for the 28th ult., there are in America fifteen Gas Associations, and five others having in their membership men connected with electric lighting and motor industries, especially those of the tramway type. The Canadian Gas Association and the Natural Gas Association bring up the total to 22. Of these Associations three are national in scope; the others covering either single or adjacent States. The New England Association of Gas Engineers is the oldest, having been formed in 1871. Of the other Associations, six were started prior to 1904, as follows: Society of Gas Lighting (1875), Guild of Gas Managers (1880), Michigan and Pacific Coast Gas Associations (1893), Missouri (1897), Kansas (1898), and Wisconsin (1900). During the past five years, fourteen Associations have been formed; and others are being tentatively considered. This marked increase in number, as well as in membership, is, the writer states, in line with all the other important industries of the country; and he thinks it augurs well for the gas section. The papers and discussions have increased in merit and broadened in scope.

## CONVERTING CARBON MONOXIDE TO METHANE.

In a recent number of the "Journal für Gasbeleuchtung," Herr E. Erdmann dealt with the subject of the technical solution of the problem of preparing methane from carbon monoxide or non-poisonous illuminating gas from water gas. Pending a fuller notice of the article which is in preparation, we give the following abstract from the current number of the "Journal of the Society of Chemical Industry."

It is stated that the problem of converting the carbon monoxide in water gas into methane on a technical scale by the Sabatier and Senderens catalytic method has been solved in an experimental plant installed in England by the Cedford Gas Process Company. The failure of Elworthy's earlier attempt in this direction was due chiefly to two causes—viz., the deficiency of hydrogen in ordinary water gas, and the loss of activity of the nickel used as catalyst. These difficulties have been overcome in the process described in the paper, the principal new feature of which is that the water gas, after being washed and freed from tar and carbon dioxide, is partially liquefied in a Linde apparatus in order to separate it into a portion rich in hydrogen and another consisting mainly of carbon monoxide. It is found best to adjust the valves of the apparatus so that the gas evolved contains from 13 to 14 per cent. of carbon monoxide, and then to add sufficient of the portion rich in this gas (93 to 94 per cent.) to bring the content of it up to 17 per cent. When once the valves have been regulated, it is possible to obtain continuously a gas containing 17 per cent. of carbon monoxide, 79 per cent. of hydrogen, and 4 per cent. of nitrogen. The content of carbon monoxide at different times does not vary by more than a fraction of 1 per cent. The portion of the gas rich in carbon monoxide from the Linde apparatus is utilized for working the compressors. During its passage through the Linde apparatus, the gas is freed completely from the sulphur compounds which were the chief cause of the loss of activity of the nickel catalytic mass in the subsequent reduction process.

The reduction apparatus consists of three vertical quartz tubes, 1½ metres long and 12 centimetres in diameter, each containing pumice impregnated with 200 grammes of finely divided nickel. The tubes are contained in an iron casing, which is heated electrically to from 280° to 300° C. at the beginning of the process. The gas also is preheated before passing into the reduction chamber. After the reduction has once commenced, more than sufficient heat is evolved not only to maintain the temperature of reaction but to heat the entering gas to 300° C. From the reduction chamber the gas passes through a condenser (to separate the water) to the holder.

Details of an experimental run of 60 hours are given. Of gas rich in methane 392 cubic metres (13,840 cubic feet) were obtained from 1080 cubic metres (38,140 cubic feet) of crude water gas; and 268 cubic metres (9464 cubic feet) of carbon monoxide were obtained as a secondary product from the Linde apparatus. The water gas used contained 51·7 per cent. of hydrogen, 39·5 per cent. of carbon monoxide, 4 per cent. of carbon dioxide, and 4·8 per cent. of nitrogen. It had a heating value of 2542 in each case. The mixed gas entering the reduction chamber contained 80·9 per cent. of hydrogen, 16·3 per cent. of carbon monoxide, and 2·8 per cent. of nitrogen (calorific value 2592 calories); and after reduction it consisted of about 31 per cent. of methane, 62 per cent. of hydrogen, and 6 per cent. of nitrogen, with traces of carbon monoxide and dioxide, and having a heating value of 4220 calories.

The cost of the process depends primarily upon the cost of the water gas. For English conditions, the following figures are given:

| | s. | d. |
|---|---|---|
| 12,360 cubic feet of water gas, at 2·45d. per 1000 cubic feet | 2 | 6·3 |
| Cost of conversion into 4485 cubic feet of gas containing about 32 per cent. of methane, at 1·76d. per 1000 cubic feet of the latter | 0 | 7·9 |
| Cost of 4485 cubic feet of "synthetic gas" or 8½d. per 1000 cubic feet. | 3 | 2·2 |

The working of the process in connection with bye-products coke-ovens is contemplated; and it is estimated that it will be possible to produce a "mixed gas" at a cost of 4·3d. per 1000 cubic feet (excluding freight of coal) by adding to the coke-oven gas an equal quantity of the "synthetic gas," and carburetting the mixture so that it has an illuminating power of 14 candles. The water gas can be replaced by Mond gas; and where this is available, it is undoubtedly the cheapest raw material for the production of the "synthetic gas"—1000 cubic feet of the valuable constituents (carbon monoxide, hydrogen, and methane) of Mond gas costing only 0·8d.

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The current number of the "Engineering Review" contains an article on "Representative Scottish Works," in which reference is made to two in which readers of the "JOURNAL" are interested—viz., those of Sir William Arrol and Co., Limited, and Messrs. Stewarts and Lloyds, Limited. The writer says no name has shed more lustre on Scottish engineering achievement than that of the former firm, for the reason that none has executed work of more importance or greater magnitude; while there is perhaps no firm which is mentioned with greater esteem in iron circles than the latter, whose ramifications include all that is necessary for the production of iron and steel tubes by every process, and whose system of jointing assures absolute safety from leakage.

# CORRESPONDENCE.

*[We are not responsible for opinions expressed by Correspondents.]*

### Double Holiday Pay for Gas-Workers.

SIR,—Referring to your remarks upon the recent concession by the Gaslight and Coke Company of an extra week's pay for holidays, your readers may be interested to see the following extract from the Directors' minute book of the South Metropolitan Gas Company.

*At a Meeting of the Board held at the Old Kent Road Works, June 17, 1872.*

"The Engineer and Secretary reported that the regular men in the Company's employ had given him great satisfaction in the manner they had performed their duties, and suggested—with a view of further attaching them to the Company and as a mark of appreciation of their conduct—that an extra week's pay be given to each man on the occasion of his going for his week's holiday.

"RESOLVED. That such suggestion be adopted."

The above shows that Mr. George Livesey was a pioneer in this movement, as he was in many others affecting the prosperity of the gas industry and the welfare of its workers.

The payment of double wages for holidays has been continued ever since.

CHARLES CARPENTER, Chairman,
South Metropolitan Gas Company.

709, *Old Kent Road, S.E.*,
*Sept.* 23, 1911.

### Who are the Gas Companies, and Who the Gas-Stove Firms?

SIR,—I see in your latest issue that Mr. H. James Yates is endeavouring to allay the apprehensions in gas circles that electric cooking is going to be a keen competitor with gas for that purpose.

Quite apart from my personal opinion on the matter, could you tell me why certain gas companies have threatened to withdraw gas-stove orders from manufacturers who supply castings for electric cooking ranges?

It is a fact that such threats have been made, and have effectually stopped some firms supplying castings for electric cooking.

Surely *if* electricity (1d. per unit) is five times the cost of gas (2s. 6d. per 1000 cubic feet) for cooking, as you would have your readers believe, the gas companies in question must have other reasons than the fear of competition for such an action.

Can you or any of your readers tell me what these reasons are?

H. H. HOLMES,
Sales Manager, Borough of St. Marylebone Electric Supply.
*York Place, W., Sept.* 22, 1911.

[Quite in accordance with the electrical mode, Mr. Holmes draws deeply on his imagination. There are no apprehensions to allay in gas circles respecting any competition from the electric-cooker; but there are a few claims made for the latter and against gas-cookers that have, in the ordinary course of commercial competition, to be combatted. It is also within our province to keep our readers informed as to the aspirations, experiences, and claims of electricians in this matter. But we fail to detect even a molecule of apprehension in this. Regarding the paragraph of the letter commencing "Surely *if* electricity (1d. per unit) is five times the cost of gas (2s. 6d. per 1000 cubic feet) for cooking, as you would have your readers believe," let us ask Mr. Holmes a question so as to start on a proper footing: Does he deny, or does he agree, that the relations between the B.Th.U. that a unit of electricity is capable of generating and the B.Th.U. that a pennyworth of gas (at 2s. 6d.) is capable of generating, are approximately 3500 and 16,500? That is the point made last week in our "Correspondence" columns; and it is not a question as to what we would have our readers believe, but it is a question of fact. We know that our electrical friends do not like this as the commencing point of the argument, as it quickly leads them into a *cul de sac* in the matter of the capacity of their cooking appliances for developing increased efficiency. Then Mr. Holmes asserts that certain gas companies have threatened to withdraw gas-stove orders from manufacturers who supply castings for electric cooking-ranges; and he says it is a "fact" that such threats have been made, and have effectually stopped some firms supplying castings for electric cooking. We invite Mr. Holmes to drop covert allegation, and to state openly who are the gas companies (plural) from whom the threats emanated, and who are the firms (plural) who, in consequence of the threats, refused to supply electric-cooker castings. He declares that what he states is a "fact." If it is a "fact," no harm can come to him from making an open and substantiating statement in our columns. This would have much more effect than the form of his present assertion. We see no reason whatever why any gas company should make the supply of electric-cooker castings a reason for boycotting any gas-stove firm—inasmuch as the depriving of a gas-stove firm of the business, only means its transference to other quarters. We really fail to see what purpose is to be served by exercising influence in the manner suggested by Mr. Holmes. It is, of course, quite conceivable that gas-stove firms would be loath to supply their special gas-stove castings for competitors to use. However, we do know this, that the gas-stove firms have about as much work as they can get through in executing

orders for gas stoves and fires of all descriptions—in fact, the past two winter seasons have seen some of them working beyond normal time in order to comply with demand.—Ed. J.G.L.]

Gas-Stove Makers' Denials.

Since the foregoing was written, we have made inquiries direct to the gas-stove makers of this country, as to the truth of Mr. Holmes's allegation; and there is indignant denial from all quarters as to gas companies ever having brought any pressure to bear in the manner indicated. Four of the firms inform us that we are at liberty to use their names in support of their denial; but as the other nine letters do not mention similar permission, we will (in the absence of authorization) give extracts from the letters:

(1) We are pleased to inform you that we have not received a threat in any shape or form from any gas company we deal with with regard to the matter in question; and you are at liberty to use our name to support a denial of the allegation.

(2) As far as we are concerned, there is no truth in any suggestion that gas companies have threatened to withdraw orders from us should we supply castings for electrical cooking ranges.

(3) We have to say that no such statement from any gas undertaking in regard to supplying electrical companies with either castings or cooking-stoves has ever come to our notice.

(4) We may say that we have not supplied any such castings, nor have we received any threats from gas companies.

(5) We have no knowledge of the matter here, nor do we think there is any possibility of it having reference to this company. However, we wrote our works on the subject last night, and will write you further on receiving their reply.

(6) No such steps as you mention have been taken by gas companies in connection with our firm.

(7) We have no knowledge of gas companies withdrawing gas-stove orders on account of our making castings for electric cooking-ranges.

(8) *Re* antagonism of gas companies to firms supplying castings to electric companies, we have no knowledge, personal or otherwise, of such being a fact.

(9) We beg to say this is the first intimation we have ever received of this matter.

(10) We are not aware of any such threat having been made to us.

(11) We have never had any difficulty in the direction you name.

(12) No such steps have been taken by any gas company that we supply, and, further, most gas companies are fully alive to the drawbacks and difficulties that confront the system of cooking by electricity. It is difficult to credit what Mr. Holmes asserts.

(13) A telephonic message from another leading firm of gas-stove makers gives us full permission to use their name in denying that any gas company have issued such a threat as the one referred to in our Marylebone correspondent's letter.

With these letters in our possession, we again challenge Mr. Holmes to substantiate his statement by publishing the names of the gas companies and of the gas-stove firms to whom he refers. In the absence of the justification, our readers will know the proper judgment to pass on that gentleman's assertion.—Ed. J.G.L.

## The Carbonizing Chambers and Gasholder at Vienna.

Sir,—In the "Journal" for Sept. 5 a view was given (p. 586) which is designated as an illustration of an inclined carbonizing chamber plant at the Leopoldau Gas-Works belonging to the City of Vienna. That is a mistake. The plant in question is a horizontal carbonizing chamber plant for a daily production of more than 7,500,000 cubic feet, heated by a central generator plant. At the Simmering Gas-Works, Vienna, a similar plant of 2,200,000 cubic feet (which was recently enlarged to a daily production of 6,300,000 cubic feet) has been working for some months now. The figures named in the "Journal" respecting the inclined carbonizing chambers plant are correct. The plant, however, does not exist at the Leopoldau works, but is at the Simmering Gas-Works.

Further, may I say that the gasholder, which is seen in the background of the view, is not the same holder the crown of the bell of which was damaged while being tested in August. The damaged holder (which will soon be renewed) is about eight miles from the Leopoldau works. It is, however, filled from that works by means of a high-pressure pipe-line.

*Vienna, Sept.* 16, 1911. F. Menzel, Director.

[We thank Herr Menzel for pointing out the mistakes into which we were led by the correspondent to whom we were indebted for the photograph and particulars that were published in our Sept. 5 issue.—Ed. J.G.L.]

## Development of Bye-Product Treatment.

Sir,—In your issue of Sept. 19, Mr. G. Stanley Cooper, in his article on the "Development of Bye-Product Treatment," says:

> The principal feature of the Otto-Hilgenstock direct process—*i.e.*, the absence of all ammoniacal liquor—cannot be worked in connection with benzol recovery owing to cooling being necessary, and consequently condensation would take place and some liquor would be produced. If, however, the process is modified, so as to produce a small amount of liquor, benzol can be recovered efficiently. But in this case, distillation is necessary, if the whole of the ammonia is to be recovered.

It is quite true that where the Otto direct recovery system is in operation, and where benzol scrubbers are employed, it is necessary to cool the gas, but only after it has passed through tar sprays and a saturator; and consequently a certain amount of condensings are obtained. But all the ammonia has been taken out of the hot gas previous to cooling. So, contrary to Mr. Cooper's statement, there is absolutely no need for any distillation—in fact, there is no ammoniacal liquor to distil.

It should also be remembered that as no lime is used, and as all the ammonia has previously been taken out of the gas, the condensings from the coolers before the benzol scrubbers are neutral, and so have very little solvent action on the sulphuretted hydrogen and the cyanogen compounds in the gas. The bulk of these obnoxious impurities therefore passes on with the gas, and is burnt in the oven-flues. On the other hand, the waste liquor from the old indirect methods, as well as from the Koppers semi-direct recovery system, not only contains lime (which is itself highly deleterious) but also quantities of poisonous sulphur and cyanogen compounds.

In the Otto system, the gas leaving the coolers passes to the benzol scrubbers, where the benzol is washed out of the gas by means of creosote oil, and subsequently recovered in the usual way. To the writer's knowledge, an Otto-Hilgenstock direct recovery plant with a benzol plant attached on the above lines is at the present time working, and giving thoroughly good results, at Messrs. Cochran's colliery at New Brancepeth, co. Durham.

*Norwood Terrace, Headingley, Leeds, Sept.* 21, 1911. J. B. Deakin.

## Is Capital Injured More Than Labour by Strikes?

Sir,—The above is a question that should be put pointedly to the miners' agent, M.P.'s of the Socialist group, and also to Fabian parliamentary candidates who are masquerading in Monday morning suits of productive-labour overalls. It is being put to themselves by thousands of reflecting men of all shades of thought and all colours of politics, since Mr. Thomas, ex-M.P., made the startling statement that the Miners' Federation, during the prolonged strike at the Cambrian Collieries, Limited (of which he is the Chairman), had paid out more money in strike pay than would have purchased the great Cambrian collieries, and made the colliers owners of one of the greatest properties in South Wales. These extensive collieries, however, are still the property of the shareholders; and the colliers have gone back to the pits as workers (after using up huge accumulated funds, or liquid capital, sufficient to buy the pits outright, apart from having lost about twelve months' wages), with only their labour remaining again in their possession, to win the coal at the same price per ton as they were receiving when they came out on strike.

I shall leave it to others more *au fait* with the teachings of Adam Smith's great book to apportion the injury done respectively to capital and labour during the long strike at the Welsh collieries. I am, however, sufficiently cognizant of the laws of economic science to know that at the collieries the work is carried on, not for the immediate benefit of the shareholders (many of them comparatively poor thrifty people), but firstly to pay the wages of the miners. It is capital which provides the wages of the sinkers and surfacemen; and without capital (the savings of others) the workers could not be maintained during the long and expensive non-productive preliminary operations before the coal is reached. It is capital which provides the costly plant and machinery to equip the pit; and without capital it could not be started. With plenty of capital to start new ventures and develop new industries, there is always better employment for labour. This is the essence of the teaching of political economy, confirmed by the experience of commercial history; and this experience is right up against the lachrymose vapourings of Labour-Socialism.

As a practical trained miner, a certificated colliery manager of thirty years ago, and a modern mechanical manufacturing engineer of to-day, I am glad to notice, in my travels in the colliery districts, a thoughtful mood springing up recently among miners; and in conversation with former mine mates, I was pleased to find they realize some of the elementary truths of economics, and have of late begun to grasp, in part, the commercial axiom that a man gains wealth when he employs productive labour, and sees his savings grow less while he sustains non-productive workers, whether in sinking a coal pit, building new gas-works, erecting a factory, or equipping a modern engineering works. Still, though the thrifty small business men or saving workers see their savings dwindle for a time, as well as those of big capitalist investors, they believe their capital will come back with a profit. Capital moults betimes, to be followed by a full-feathered period of golden-egg-laying, or the capital hen would never sit.

Three things are essential to the paying production of useful products—labour, capital, and brains; and in this scientific and inventive age, the greatest of these is brains. The great agricultural and industrial chemists—the late Sir James B. Lawes, Bart., and the late Dr. Ludwig Mond—whose epoch-making discoveries doubled production, were the greatest benefactors of mankind; and the inventors and manufacturers of appliances who increase production and improve or save labour are hardly less so. Let me repeat, it is capital and brains which provide the wages of labour; therefore the workers should give little heed to Socialistic demagogues, who untruthfully proclaim that "labour creates all capital." The day worker in the mine, the gas-works stoker, the moulder in the foundry, and the engineer in the works, will be most useful to themselves, and greater aids to their brethren, if they go on pondering (now that they have begun) the truth that it is brains and capital, by inventions and improvements to plant and machinery, which help the daily wage-earners to better wages, less exertion, and more home comforts. Whatever Fabians and Labour-Socialists may preach and teach, the incontrovertible truth is contained in the foregoing sentence; and as technical and commercial knowledge spreads and deepens among the toiling masses, either above or below ground, the "flapdoodle" Fabians who talk much about divide while not any of them provide, will be as much ridiculed, when they denounce owners of savings, as are "splay-headed" drivellers who "toil not neither do they spin," when they attempt to belittle the benefits rendered to the Empire by the brain-workers who are the world's greatest wealth producers.

This letter having already run to an inordinate length, I shall, with your permission, in a future communication, answer the question generally with which I started; contenting myself meantime by asking your readers of all political colours to keep this in mind: Capital and labour are interdependent.

*Bradford, Sept.* 21, 1911. Gilbert Little.

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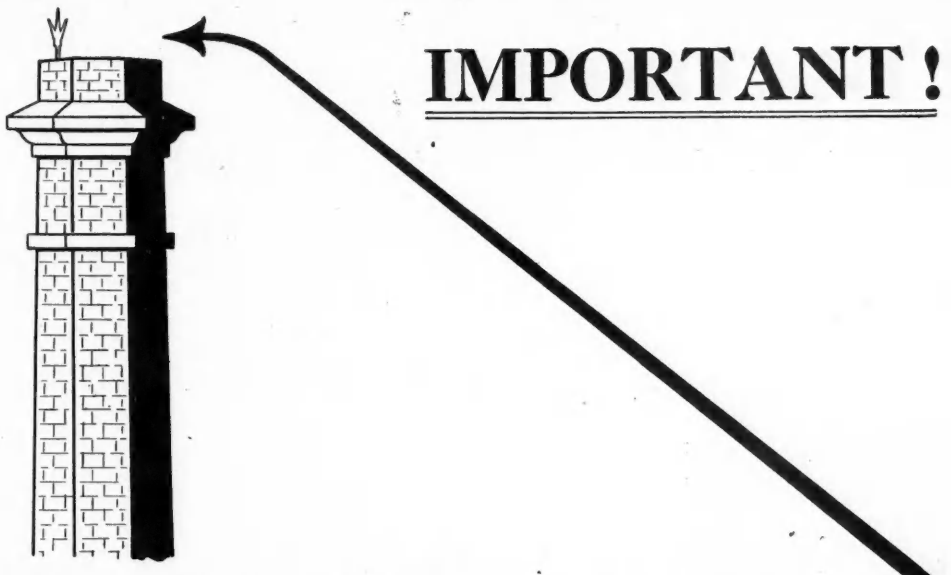

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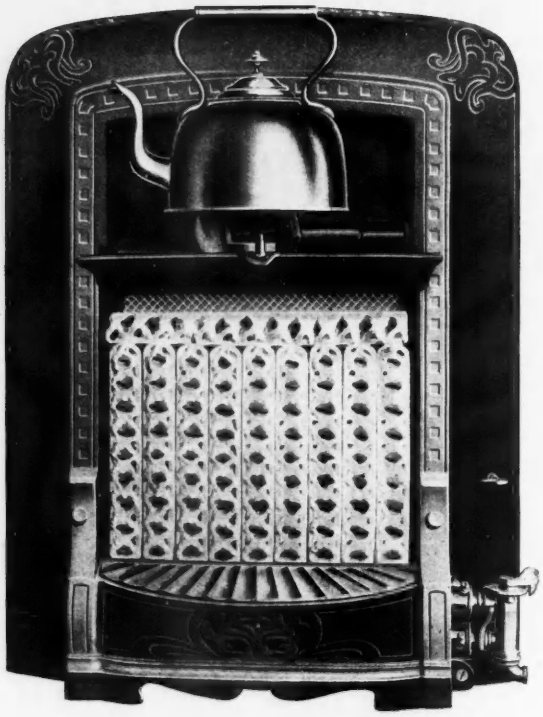

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**"SAVOY,"**

**WITH BOILING HOB.**

**(PATENT APP.).**

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**WILSON 1911 FIRE.**

**"SAVOY,"**

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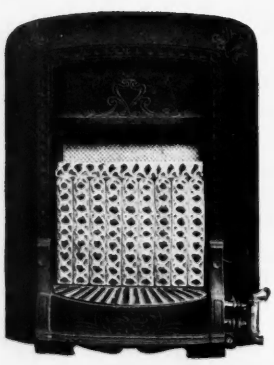

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# LEGAL INTELLIGENCE.

## NON-PAYMENT OF WATER-RATES.

### A Question of Committal.

On Monday, the 11th inst., at the Altrincham Sessions, before a Bench of Magistrates, Mr. J. Hunt (Collector) appeared on behalf of the North Cheshire Water Company, and asked the Bench to commit a man recently residing at a Sale address for non-payment of water-rent and costs. He said that defendant was summoned to appear that morning, in person, to show cause why he should not be committed to prison. The circumstances were briefly as follows: The defendant was summoned two months ago and failed to appear. The usual order was then taken out, and subsequently the goods were marked on a distress order. It was, however, afterwards found that the furniture had already been in possession of another party for rent; and thus the distress warrant had to be returned "No effects." A further order was then granted calling upon the defendant to show cause why he should not be committed; but there had been a difficulty in finding him and serving him personally. Application was then made to the Bench to substitute service; and this was then duly performed by Inspector Sharp at the defendant's last-known place of business. In the alternative of defendant not appearing that morning, he applied that a committal order be granted.

The Bench stated that they could not grant the order, unless Mr. Hunt brought evidence to show means.

Mr. Hunt remarked that this course was impossible; for it was obvious that, if a previous Court had granted leave to substitute service, and they could not find the defendant, they could not show what income he had.

The Clerk pointed out that they could summon a member of the firm to give evidence as to the amount defendant received.

Mr. Hunt said a member of the firm would be a member of the defendant's own family, and would be clearly a hostile witness. Besides, there was the question of further costs and little likelihood of getting them back.

The Clerk said Mr. Hunt must either have the order dismissed or apply for an adjournment.

Mr. Hunt replied that he was bound to put before the Bench the extraordinary position he was in, assuming for the moment that they did not accede to his request for the defendant's committal. The Company had already been mulcted in costs amounting to over £1; they had carried out all the requirements of the law, and had attended the Court on several occasions; and the Magistrates had made out all the orders upon the defendant that the Company had asked for—all of which had been ignored. In such circumstances, he respectfully suggested that all a defendant had to do, provided he had no goods or had made away with them, was to ignore the orders of the Magistrates, and treat them with contempt—to render the whole process of the Court futile and inoperative. This case was not associated with the question of poverty or of no means to discharge the debt, but was a deliberate move to keep out of the way and to ignore the law. He submitted that he might reasonably ask the assistance of the Bench.

The Magistrates retired to consider their decision; and on their return, the Chairman said they had carefully considered the points raised, but there was not sufficient evidence to warrant committal.

Mr. Hunt then applied for the order to be adjourned for two months, which was agreed to.

## HEAVY FINE FOR UNLAWFULLY USING WATER.

At the Aldershot Police Court on the 14th inst., a man named Greenwood was summoned for affixing a pipe to a surface drain without the consent of the Aldershot Gas and Water Company, and with unlawfully using water for other than domestic purposes.

Mr. Norman Clinton, who appeared for the prosecution, said the case was one of great gravity. Certain information came to the Company, with the result that a watch was kept on defendant's premises and certain tests made. It was found that about 10 o'clock at night, the water which had otherwise not been running on the premises, started to run freely. Immediately afterwards lights would appear upstairs; the defendant would go to bed; and all the lights would be turned out. He would therefore ask the Magistrates to presume that the water was to be allowed to run all night. This was discovered on Sunday night. On Monday a watch was kept; and it was found that the water was turned on and was running up to midnight, when the Company's witness left. The lights in defendant's house on the night had been out since 10.30. On the Tuesday, the Company's Superintendent with the police again visited the premises, and the same thing happened—water starting to run before defendant went to bed, and continuing to run. On looking through the scullery window they saw fixed to the tap over the sink a piece of india-rubber piping, which went to the waste hole and stopped the splashing. The water then ran into the gully outside, along a drain into a tank, and from the tank into a pond in defendant's meadow, 15 feet long, 5 feet wide, and 18 inches deep. The water continued through an open gully, 180 feet long, into another pond on defendant's premises, 60 feet long, 4 feet wide, and 9 inches deep. The capacity of the settling tank was 2000 gallons; the large pond, 1000 gallons; the small pond, 700 gallons; and the trench, 834 gallons. In the meadow were forty head of Government cattle, which required water; and this was the method adopted by defendant to get the necessary supply. The question of the amount of water had been tested. The running tap represented 500 gallons per hour, which meant more than 4000 gallons during the night—assuming it was turned on when defendant went to bed, and turned off at 6.30 a.m. This was going on to the Company's knowledge for three nights—representing a total of 12,000 gallons for the period. Counsel added that if defendant's cattle were turned out during June, July, and August, when hardly a drop of rain fell in Aldershot, the Magistrates could form some idea of the amount of water that might be used by defendant during this period, because he could not have got the water from anywhere else.

A Superintendent (named Bell) in the employ of the Company, said that on Sunday, the 10th inst., he went to defendant's meadow, where he found two small ponds connected by a channel, and saw also running water. He was unable to trace the source of it that night. He took a sample of the water, and handed it next morning to the Medical Officer of Health. Having received the result of the analysis, he made investigations again on Monday. On that day there was no water running, neither was there between 8 p.m. and 10 p.m. After 10 p.m. he found water passing freely through the service-pipe. He saw the lights in defendant's house go out that night, and the water was running until midnight. On Tuesday night he went to the premises with Inspector West. At 10.30 p.m. the lights were out and the water was running very freely. He went on to the premises, and found the water was passing into the gully outside the scullery window. He called defendant, who came downstairs, and he told him he wished to investigate a serious leakage of water. Defendant said the scullery tap was running, and witness went with him to the scullery, where he found a rubber pipe connected with the tap, and water running through it into the sink. The tap was running full bore. Defendant admitted the tap would run until he got up in the morning; and he afterwards admitted that it had been running on the two previous nights. Witness subsequently took samples of water from the settling tank, the large pond, and the scullery tap. He bore out Counsel's statement with regard to the quantity of water running, and said the minimum charge would be 1s. 6d. per 1000 gallons.

Witness added that at the height of 3 feet there was a hole in the tank to allow the water to escape into the pond when there were 3 feet of water in the tank.

Inspector West said that defendant said to him, when asked to give an explanation: "It goes into the drain outside, then into a tank, and then into a pond at the bottom of the field. There are about forty cattle there belonging to the Commissariat. They only came last Friday, and most of them are going away to-morrow morning."

Dr. E. W. Routley, Medical Officer of Health, gave evidence that he had analyzed the samples of water, and was of the opinion they were mainly composed of Aldershot town water.

Defendant said he had plenty of water, and could pump 40 feet into the same tank. He admitted he had done a silly thing, but nothing so bad as the Company said.

Mr. Clinton said the case was a serious one, and as the penalties under the Act were very small, he asked that the Analyst's costs and the Company's legal costs might be allowed.

On the first charge defendant was fined £3 18s., including costs, and in the second case £2 8s. inclusive—a total of £6 6s.

## Gas Matters at Maryport.

The Gas and Water Committee of the Maryport Urban District Council recently appointed a Special Committee to consider questions relating to a supply of coke-oven gas and the extension of the area of supply, and authorized them to call in an experienced gas engineer to advise thereon. The Special Committee submitted a report, in which they recommend: (1) That in view of the position taken up by the Flimby and Broughton Moor Coal and Fire-Brick Company as to the conditions of the supply of gas from the coke-ovens, the Committee are of opinion that it is useless to persevere at present with the negotiations, and recommend that they be dropped; and (2) that, in view of the report of Mr. Hepworth on the cost of making gas at the Council's works, the Gas and Water Committee be recommended to take the matter into consideration forthwith. The Gas and Water Committee having considered the report of the Special Committee, it was resolved that the first of the recommendations of the Special Committee be approved and adopted, and the negotiations with the Colliery Company dropped meanwhile. It was also resolved that the Special Committee be requested to further consider and report on the cost of manufacturing gas at their works.

**Reduction in Price at Dumbarton.**—The Dumbarton Town Council have reduced the price of gas by 3d. per 1000 cubic feet to ordinary, and 4d. to slot-meter, consumers; making the rates 2s. 6d. and 3s. respectively, which are among the lowest all-round prices in Scotland. The annual instalment of £500 will be transferred from profits to the suspense account to partly defray the cost of new purifiers and exhausters now being installed. These extensions form part of the scheme of the Manager (Mr. J. G. M'Geachin) for remodelling the works.

**Alliance and Dublin Consumers' Gas Company.**—The accounts of this Company for the six months ended the 30th of June, which will be presented at the half-yearly meeting next Saturday, show that the total revenue was £153,715, and the expenditure, including interest on loan capital, &c., £113,840; showing a profit of £39,875. From this amount a sum of £5000 has been written off the suspense account; leaving a balance of £34,875, to which is to be added £5204 brought forward; making a total of £40,079 to the credit of the profit and loss account. The Directors recommend a dividend on the consolidated ordinary stock at the rate of 5 per cent. per annum, after payment of which a balance of £3545 will remain to be carried to the next account.

**Gas-Cookers in Leeds.**—Great difficulty is being experienced, even though they are working overtime, by the fitters of the Leeds Corporation Gas Department in keeping pace with the demand for gas-cookers. Last month a record was established; no fewer than 423 cookers being fixed by the department, as compared with 65 during the corresponding month of last year—an increase of 358. Thus last month over six times as many gas cookers were supplied as in the corresponding period of the previous year. The Manager (Mr. R. H. Townsley) explains that this enormous increase is chiefly due to the fact that the Gas Committee have reduced their charges for the use of the cookers. Whereas formerly the cost was 10 per cent. of the list price per year, it is now only 10 per cent. of the cost price to the Committee. In consideration of this reduction, the consumer has had to forego the right of ownership when the value of the cooker has been paid in rent.

# MISCELLANEOUS NEWS.

## GLASGOW DEPUTATION VISIT TO LONDON AND THE PROVINCES.

### Inspection of High-Pressure Lighting Installations.

The deputation from the Corporation of Glasgow to view the high-pressure gas lighting in the City of London—consisting of Bailie Paxton (Convener of the Gas Supply Committee), Bailie Kirkland (Sub-Convener of the Gas Supply Committee), Councillor Pratt (Convener of the Lighting Committee), Councillor James Stewart (Bromielaw Ward), and Councillor James Stewart (Townhead Ward)—accompanied by Mr. Alex. Wilson (the Gas Engineer), Mr. J. J. Cairns (of the Town Clerk's Department), and Mr. S. B. Langlands (the Lighting Inspector), were received on Monday of last week at the Guildhall, in the absence of the Chairman of the Streets Committee, by Mr. Deputy Morton, M.P., accompanied by Mr. J. W. Domoney, L.C.C., and Mr. Deputy Wallace, J.P.

In the evening, the members of the deputation, together with Mr. Jacques Abady (Chairman of the Streets Committee of the City of Westminster), Mr. F. W. Goodenough (Controller of the Gas Sales Department of the Gaslight and Coke Company), Mr. W. Doig Gibb (Chief Engineer of the South Metropolitan Gas Company), and Mr. Stokes (Chief of the Maintenance Department of the South Metropolitan Gas Company), were hospitably entertained at De Keyser's Royal Hotel, and then proceeded to view the lighting in the following thoroughfares: Blackfriars Bridge Approach, over the bridge to the south side (South Metropolitan Gas Company), Queen Victoria Street, Cannon Street (where a demonstration was given of raising and lowering the centrally-hung inverted gas-lamps), the compressing station, Lower Thames Street, Eastcheap, Great Tower Street, over the Tower Bridge, and back to the Mansion House, Poultry, Cheapside (where a demonstration was given of raising and lowering the centrally-hung electric arc lamps), St. Paul's Churchyard, Ludgate Hill, New Bridge Street, and Fleet Street, to Temple Bar.

The deputation from Glasgow on Tuesday went to Birmingham. They were received at the Council House by the Lord Mayor (Alderman Bowater) and the members of the Birmingham Gas Committee, after which, accompanied by the Chairman and several members and officials of the Gas Department, they visited the high-pressure laboratories in Cornwall Street, and also the Windsor Street Gas-Works. Subsequently they inspected the high-pressure governor at King's Norton, and finally saw the system of lighting by high pressure in the Museum, in Victoria Square, and in Stephenson Place.

After inspecting the installations in the cities which it had been arranged to visit on this side, the deputation left England to pursue their investigations on the Continent.

## CO-PARTNERSHIP AT PLYMOUTH.

A meeting of the employees of the Plymouth and Stonehouse Gas Company was held at the works last Thursday, to consider the scheme of co-partnership which was announced at the annual meeting of the Company. Sir Joseph Bellamy, the Chairman, presided; and most of the members of the Board were present, as were also Mr. Percy S. Hoyte (the Engineer and Manager), Mr. H. B. Heath (the Secretary), and other officials. Most of the employees attended the meeting, which was held in the dinner hour.

Sir Joseph Bellamy referred to the announcement which he made at the annual meeting of the Company, of the Directors' intention to adopt a co-partnership scheme, and said they were following on the lines of some other gas companies, who had found the scheme work satisfactorily and to the advantage of all concerned. For some years, the Directors had been anxious that the workpeople should have a larger share of the profits; and the scheme would have been brought forward earlier, but for the fact that they had had to contend against keen competition, and to meet the conditions which arose through the doubling of the assessment of the works. In adopting the scheme, it was the desire of the Directors to give their employees something over and above what they were getting now. Nothing would be taken from them; and such benefits as were granted by the Workmen's Compensation Act and the like would still be theirs. Even the Company's non-contributory pension scheme would continue. Though there were few undertakings except gas companies which had adopted a co-partnership scheme, he did not see why many big works should not follow their lead. It would solve many difficulties if the employees were allowed to have a share in the progress made in prosperous times. The basis of their own scheme was that, as dividends went up, the bonus to the workmen should go up also. They took as a starting-point gas at 2s. per 1000 cubic feet, at which price the dividend on the capital invested was 5⅜ per cent. When gas went down to 1s. 7d., the present price, the shareholders were entitled to a dividend of 6⅜ per cent. Under the scheme, for each reduction of 1d. in the price of gas below 2s., the men would receive 1 per cent. on their year's wages. It had been decided that the scheme should operate for the past year as well as for the present year; and, as a result, he could announce that already the Directors had to distribute among them £750. For the present year, with the price of gas at 1s. 7d., it was estimated that the amount of distribution would be £938. The bonus would be payable on the weekly wages, and hours of overtime would be included in the reckoning. Taking the case of a stoker earning from £95 to £100 per annum, on March 31 next he would have £9 to his credit. The sum of £6 10s. would buy stock in the Gas Company; and the balance of £2 10s. would be divided between a fresh accumulating sum to buy more stock and a little deposit account on which they would allow 4 per cent. interest. The Directors hoped that the deposit account would only be drawn upon in time of emergency, and that it would be a means of encouraging thrift. At present, the scheme would only apply to regular weekly wage-earners. For some years, the officials and clerical staff had been receiving a bonus, which would continue; and the Directors hoped to allow them to come in under the co-partnership scheme at a future date. Later on they might also include the casual employees.

Mr. J. Walters, foreman of the works, moved the adoption of the rules embodying the scheme, and said it was quite evident that it was for their advantage. He was pleased to find that they were to still have the benefit of the Workmen's Compensation Act.

Mr. W. Ford, foreman fitter, seconded; and the scheme was unanimously approved.

Sir Joseph Bellamy expressed the hope that the scheme would be carried out as between man and man, and not as between employer and employee. It would be administered by a Committee, on which they would have equal representation. He was satisfied that, though the shareholders were making a sacrifice, in the long run it would pay. It was well for a Company to be on good terms with their workpeople; and £1000 lost to the shareholders came back in good feeling.

Mr. O. P. Ellis, the Secretary to the Co-Partnership Fund, announced the arrangements made for the election of the Committee; and the meeting ended with a vote of thanks to the Chairman, proposed and seconded by two of the workmen.

## PROGRESS OF THE BELFAST GAS UNDERTAKING.

### A Successful Exhibition.

The Belfast Gas Committee are holding a highly successful gas exhibition in the Ulster Hall. All kinds of appliances are on view; but on the present occasion a special effort is being made to show the usefulness of gas for lighting at high pressure and for water heating. The high-pressure lighting is carried out by the Keith and Blackman Company, the Welsbach Incandescent Gaslight Company, and the Textile Illuminating Company. A large number of apparatus manufacturers are represented; and there are cookery lectures and demonstrations by Miss E. M. Dods. In the tea-room, the baking is done by gas in full view of the visitors; and elsewhere up-to-date laundry methods can be inspected in operation.

The exhibition was opened last Wednesday; and the occasion was marked by some interesting speeches. Alderman James Craig, the Chairman of the Gas Committee, who presided, recalled the fact that a gas exhibition was held in the building two years ago; but, though it was highly successful, it only touched a comparatively small number of the large body of consumers. The Committee therefore felt that it was necessary now to hold another exhibition, to show the ratepayers the latest and best gas appliances. There were at present almost 19,000 cookers and heating stoves in use in Belfast; but there was room for great expansion in this branch of the business. The Committee, and the Engineer (Mr. J. D. Smith), had done their best to make the exhibition as complete and instructive as possible.

The exhibition was then declared open by the High Sheriff of Belfast (Councillor Crawford M'Cullagh), who pointed out that the original Gas Company was started in 1823. At that time, the works were only capable of turning out 55,000 cubic feet of gas a day, whereas now the average daily output was over 12,500,000 cubic feet—in other words, 229 times as great. The real prosperity of the concern, however, seemed to have commenced when the Corporation acquired the property in the year 1874; the purchase price being fixed at £386,550. The transfer had proved of great advantage to the citizens, who not only enjoyed a very cheap gas supply, but, in addition, had a sum of £307,521 put to the credit of the rates. When they considered that these results had been achieved after having to bring the coal from the pit to the sea, and ship it to Belfast, at considerable cost, he thought great credit was due to the Gas Committee and the officials for the way in which they had managed the concern. They would remember the discussion which took place recently in the Council Chamber relative to the extension of the gas-works, when it was finally decided that the present works should be re-constructed and modernized so as to manufacture gas by the latest and most up-to-date principles. To carry this into effect would naturally mean the expenditure of large sums of money, the interest and sinking fund on which would amount to several thousand pounds annually. It was to be hoped that there would be a sufficient growth in the output to meet the increased expenditure, as he knew it was the wish of the Committee that not only should the ratepayers still enjoy the benefits they had had, but also that they should continue to have a supply of gas at the same particularly low rate.

Councillor Squire, in moving a cordial vote of thanks to the High Sheriff, remarked that the Corporation were at present embarking upon a very large expenditure; and he wanted the ratepayers to understand, so far as his view of the matter went, that it was not the intention of the Gas Committee that the ratepayers should pay a single penny of this heavy expenditure. It would be, he believed, from the extra profits received in connection with the up-to-date manufacture of gas that they would pay every penny of the money they were about to borrow. He had confidence also that they would not only do this, but, further, that at no very distant date they would be able to supply gas to the people of Belfast at 1s. 6d. per 1000 cubic feet. The last exhibition of gas fires and cookers had resulted in an increase of 20 million cubic feet in the yearly consumption. Encouraged by this, they wanted a further increase of 20 millions, or even 40 millions, as the outcome of the present display. They were undoubtedly going forward in the production of gas. At the last Council meeting it was stated that they were now 3 per cent. over last year, which in turn showed 5½ per cent. increase over the previous twelve months, and that again an advance of 7½ per cent. over the preceding year. Thus it would be seen that, not only were they holding their own, but they were going forward. He would like to say one word with regard to the electric lighting. As a citizen of Belfast, he wished every prosperity to the department. Undoubtedly, superhuman efforts were being made to supersede gas; but a realization of the desire was an utter impossibility.

## SALFORD GAS SUPPLY.

### Another Application to Parliament Contemplated.

It being intended to include in the next Bill of the Salford Corporation a number of gas clauses, negotiations are proceeding between a Sub-Committee of the Gas Committee of the Council and representatives of the different Local Authorities whose districts are within the Corporation gas-supply area, with the object of arriving at an amicable arrangement, so as to avoid opposition when the measure comes before Parliament. The preliminary conference was presided over by the Mayor of Salford (Alderman Phillips), who is also Chairman of the Gas Committee; and the following authorities were represented: Eccles Borough Council, Swinton and Pendlebury District Council, Worsley District Council, and Barton Rural District Council. It was decided, after two hours' discussion, that the Gas Sub-Committee should submit in writing their best terms to Mr. W. T. Postlethwaite, Clerk to the Swinton and Pendlebury Council, who will then call a meeting of the joint representatives; they in turn to report to their respective Councils on the proposals made.

When last before Parliament with a Bill including clauses for a reduction in illuminating power of the gas from 18 to 14 candles, and the purchase of additional land for gas-works extensions, the Corporation were opposed by the four authorities named, whose Counsel sought to limit the profits made by the Gas Committee and the handing over of large sums out of such profits in aid of the borough rates; while the differential rate obtaining for gas supplied to the out-districts was also objected to. The House of Lords Committee, presided over by Lord Donoughmore, after a sitting extending over several days, and hearing evidence on both sides, were prepared to agree to the insertion of a clause to the effect that the Corporation should be allowed to charge a sum which would fall under the following heads: (1) A fair price; (2) interest and sinking fund on the capital for the time being outstanding; (3) a share of a proper reserve fund, which had been mentioned—the Committee accepting the figure as ½ per cent. per annum, and not exceeding 10 per cent. of the capital outstanding; (4) 1 per cent. on the capital outstanding. The Committee agreed that the same conditions should be placed upon the promoters as upon public companies in respect to the limitation of a carry-over; and they thought the capital should be raised, as and when required, with the consent of the Local Government Board. The Committee also considered that it would be fair to abolish the differential rate in the outside district represented before them; Barton to have a statutory right to the rate as everybody else. Further, the Committee thought a statutory obligation should be put upon the Corporation to charge the lighting fund with the cost of public lighting. Lastly, they expressed the opinion that a clause should be inserted in the Bill stating that if at any time, through discontinuance of the use of gas by the public, the gas undertaking of the Corporation became a total loss, and the outstanding capital be then chargeable on the rates, this charge should be shared by the ratepayers of the four outside districts represented before the Committee in proportion to the respective rateable values.

It will be remembered that, in view of the far-reaching effect of these proposals, the Bill was withdrawn by the Corporation of Salford. Alderman Phillips then pointed out that the gas undertaking existed primarily for the benefit of the inhabitants of Salford; and, secondarily, as an adjunct, came the supply to the out-districts. If the decision of Committee had been accepted, it would have practically taken away the power of the Corporation to make a profit out of the gas undertaking—a result which would have placed the ratepayers in a serious position. It is hoped that the negotiations now in progress may result in an agreement being arrived at between the Corporation and the Local Authorities concerned. In past years, all of them have spent large sums of money in contests over gas clauses in Bills.

## HIGH-PRESSURE LIGHTING IN LEEDS.

It is stated that the experiments which have been carried out by the Leeds Corporation Gas Department with the installation of high-pressure gas-lamps in Calverley Street, are shortly to be supplemented by further trials of the system in Duncan Street and New Market Street. A special main for the purpose has already been laid; and a small compressing-house is being built on a piece of land rented from the Improvements Committee. It is anticipated that everything will be ready for the beginning of the demonstration in a month or six weeks' time. The ten lamps which have been in position in Calverley Street since May last have given every satisfaction. The main which is now being put down will be quite adequate to supply the whole of the centre of the city, if required. A strong effort is to be made to induce shopkeepers and others to take up the new system for outside illumination; and already one of the largest firms in the city are in communication with the department on the subject.

## ALLOCATION OF PROFITS IN AID OF RATES.

In his annual abstract of accounts, the Borough Treasurer of Bolton (Mr. Percy Farnworth) introduces a new feature—viz., a preliminary report in which a synopsis of the finances of all departments is given under the respective headings; another useful feature introduced into the book being the placing in parallel columns of the figures for the previous year.

The accounts of the Gas Department for the year to March show the total working expenses for the past financial year to have been £116,251, compared with £115,454; while the income was £170,745, against £165,243—the increase in this case being due chiefly to higher prices obtained for the residual products. The amount transferred to the net revenue account was £4705 more than in the preceding year; and after defraying the charges for interest and the redemption of debt, the disposable surplus was £29,136, or £4893 more than in 1909-10. Of this surplus, £20,000 was applied in aid of the rates, and £9136 transferred to the depreciation account; the available balance, after spending £28,364 on extensive renewals, principally at the Gas Street works, being £37,415.

The result of the year's working of the Water Department showed a profit of £1347, against a loss of £3891 on the previous twelve months; the decrease in the cost of reservoir maintenance, filtration, and treatment, and distribution contributing the sum of £10,689—a saving of £4303 on the year. Water rents and charges brought in £3930 more than before, notwithstanding the rebate of £642 allowed in respect of licensed premises; the increase being mainly due to a revision of the trade charges. There still remains a deficiency of £2902 on revenue account; but it is hoped to wipe off this adverse balance next year, and make a contribution to the reserve fund. The capital outlay during the year was £66,117, compared with £45,957 before; and the Borough Treasurer adds that the "interest and sinking fund charges will increase rapidly while the construction of new works is proceeding."

The total indebtedness of the borough is £4,237,545; and the property and permanent works, &c., amount to £5,145,415.

Mr. A. Pilling, one of the Elective Auditors for the borough, in his report on the Treasurer's accounts, urges two reforms—one being that grants in aid of rates from the profits made in the Gas Department should be lessened, so as to allow for a quicker redemption of capital; and the other that, along with this, they should accept the principle that the consumer is entitled to larger benefits by a reduction in the price of gas. Mr. Pilling expresses the hope that the ratepayers at every ward election will make a point of asking candidates this question: "To what extent do you justify charging excessive prices to gas consumers in order to provide rate relief?" Mr. Pilling adds: "I do not say the consumer should get all the profit; but I may give this information as to the mind of Parliament on the matter. On the recent federation of six Potteries towns, a clause was inserted in the Federation Act which compels the Gas and Electricity Committees in that area to so conduct the various works that no profit shall be made which can be handed over in reduction of rates. In the event of a profit being made in any one year, the price of electricity and gas must be so readjusted as to absorb the profit. These facts should compel consideration. Widnes gas at 11d. and 1s. 1d. per 1000 cubic feet may be beyond us. But what compensation in clear atmosphere it would be if we could displace coal by cheaper gas to a larger extent."

## ELECTRICITY USERS AND GAS-COOKERS AT OLDHAM.

### The Question of a Minimum Consumption of Gas.

The recommendation of the Oldham Corporation Gas Committee for the adoption of a scale under which people using gas-cookers would have to undertake to consume a minimum quantity of gas annually, according to the prime cost of the cooker, has been rejected by the Town Council. The scheme, of which some particulars appeared in the "JOURNAL" for Aug. 22 (p. 502), proposed that in each case where the minimum consumption of gas was not reached, a fine of 6d. per 1000 cubic feet should be imposed; and the scale was to apply alike to consumers of gas and electricity having gas-stoves in use.

It was argued by those who opposed the scale that the people who did not use gas would be likely to suffer from its operation. Dealing with this point, Mr. Stanbury said this was a principle which they ought to fight against. There was a tendency on the part of small householders in the town to enjoy the privilege of electric lighting. While they had this lighting, which was supplied by the same Corporation, and was a source of profit to them, they were to be denied the privileges they would have obtained if they had not had electricity. He (Mr. Stanbury) did not think this was right; and he hoped the gas-cookers would continue to be supplied to those wanting them.

Mr. Hirst, who also opposed the adoption of the proposal, said he did not know how the Gas Committee would apportion the amount for gas used for lighting and for cooking; but supposing they reckoned, under the "C" scale, 7000 cubic feet for the former and 5000 cubic feet for the latter, making up the minimum of 12,000 cubic feet, and only 10,000 cubic feet were consumed, the customer would be 2000 cubic feet short, and would have to pay 1s. But let them take the man who did not use gas for lighting purposes. If he only used 3000 cubic feet for cooking he would have to pay 4s. 6d.; the difference between 3000 and 12,000 cubic feet. In that case, the consumer would be penalized to the extent of 3s. 6d. for daring to prefer electricity to gas for lighting purposes. In fact, he would be paying 1s. 6d. per 1000 cubic feet more than the fixed scale for the gas actually used.

The Vice-Chairman of the Committee (Alderman Thompson) denied that by the scale any consumer would be penalized; and he argued that as the Gas Department was a trading concern they had a perfect right to get interest and redemption on the money they paid out. He illustrated the case of a man who had a gas-cooker and only used it at the week-ends, with the result that the gas consumed did not pay for the interest and redemption on the cost of the cooker. If people did not want to pay the cost, let them put in their own cookers.

The Chairman of the Committee (Alderman Wilde) pointed out that previously they had assumed 8000 cubic feet for lighting and a similar quantity for cooking. Now they had come down to 8000 cubic feet for the two. The figures on which they had based their calculations were that people wanted the Committee to put in gas where they had electricity on the same conditions as had been in existence for some time. The Council must remember that the gas undertaking was a commercial one, and that if the old scale continued they and the Engineer might be called upon to say they could not manage their department and make a profit. The Chairman added that he had a list of people who used electricity for lighting and gas for cooking, and only a few would be called upon to pay if the new scale were adopted.

By 21 votes to 11, an amendment was carried, to the effect that the scale be deleted from the minutes of the Committee.

## OTTOMAN GAS COMPANY, LIMITED.

### The Development of Smyrna.

The Ordinary General Meeting of this Company was held on Tuesday last, at the London Offices, No. 9, Queen Street Place, E.C.—Colonel JAMES LE GEYT DANIELL in the chair.

The SECRETARY (Mr. Thomas Guyatt) read the notice convening the meeting; and the report (noticed in the "JOURNAL" for the 12th inst., p. 699) and the statement of accounts were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, referred with regret to the absence of Colonel Stephenson R. Clarke, C.B. Had Colonel Clarke been present, he remarked, they would have had an opportunity of congratulating him upon his honorable mention in the Coronation Gazette, inasmuch as he had been made a Companion of the Order of the Bath. Colonel Clarke had, however, been present the previous week at an important special meeting of the Board, which was fixed with a view to meeting their Engineer and Manager (Mr. John Gandon), who came over to England to discuss with the Consulting Engineer (Mr. Arthur F. Phillips) the question of an outlay of capital which was demanded for increasing the plant to cope with the development of Smyrna. It was now ten years since he (the Chairman) paid his visit to Smyrna; and he remembered telling the shareholders afterwards of the opinion he had formed with regard to the capabilities of the place. These capabilities had since been evidenced in a measure by the steady growth of the Company's business, which had far exceeded anything that he then contemplated. It was necessary, of course, that the Company should not only keep pace with what was going on, but should provide for what might be anticipated in the future. They had had the good fortune to be able to arrange for Mr. H. Ward Andrews, a member of the Board, to pay a visit to the works, over which he at one time presided; and he had made a very valuable report to his colleagues. It was everything in a place like Smyrna, and in a country like Turkey, that foreign capital should find its way in for the development of the interests from which the inhabitants were the first to reap direct advantage, because it would be almost impossible for the Turkish people to carry the work out with the benefit to themselves which they derived from having it undertaken by Europeans. There were at the present moment some works under consideration—and he believed they were financially well backed—which would involve the spending of some millions sterling of English money out there; and this would benefit not only Smyrna itself, but all the interests in the place. It was in view of all these facts that the Company had had to consider what capital outlay should be made; and this had been decided upon under the guidance of their Consulting Engineer. He thought that there was a splendid future for Smyrna. It was an extraordinarily fine port; and all that was required was good government and encouragement—not discouragement—for those who were helping towards its development. Turning to the business of the Company, the accounts before the shareholders would show them how things had been going. They had carbonized in the past six months nearly 1000 tons more coal, at a cost of only £383 more than was spent on coal in the corresponding period of the previous year. This was in a measure consequent upon the policy pursued by the Board—a policy which they had seen the advantage of, and to which he alluded twelve months ago—of arranging for the supply of coal two years in advance. The price of the coal worked out at 16s. 1d. per ton, as against 17s. 3⅜d. in 1910. The quantity of gas made and accounted for was 10½ million cubic feet more; and the make per ton was 11,010 cubic feet. There was naturally an increase in the number of public lamps under the terms of the new contract, of which this was the first year, and a consequent extension of the area and a corresponding increase in the total cost. There was an increase of some £2300 in the gas-rental, for which they had to thank the private consumers; and there was no reason for dissatisfaction in the matter of the residual products, which showed an increase of £1354. It would be observed that the amortization account had increased about £2450; and the reserve fund stood at £4000 more. He thought he had said enough to make the shareholders consider that the result of the past half-year's working was not unsatisfactory.

Mr. H. WARD ANDREWS seconded the motion; remarking that, on his recent visit to Smyrna, he was more than pleased with what he had seen—with the management of the works, with the results, and with the great increase in the population. It was most gratifying to him, as an original shareholder, and as the original manager of the works, to find such a satisfactory state of affairs. He would like to point out that in the accounts "Products, fittings, &c.," appeared in one item. A part of the £6817 under this heading was due to the fittings business, which was very extensive. They had no rivals worth talking about for doing fitting work. The fittings department of the Company's business was a big and increasing one; and he felt assured that, under the able management of Mr. Gandon, it would continue to develop.

The resolution was at once carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. STRACHAN C. CLARKE, dividends for the half year were declared at the rate of 7 per cent. per annum on the preference shares, less income-tax, and at the rate of 8 per cent. per annum on the ordinary shares, tax free.

The CHAIRMAN proposed, and Mr. A. M. PADDON seconded, a hearty vote of thanks to the Engineer and staff in Smyrna and in England.

This was accorded, and suitably acknowledged by Mr. GUYATT and Mr. PHILLIPS.

A vote of thanks to the Chairman and Directors—on the proposition of Mr. A. W. OKE, seconded by Mr. H. F. DODGSON—brought the proceedings to a close.

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Messrs. Thomas Glover and Co., Limited, of the Gothic Works, Edmonton, N., have sent us a copy of the new edition of their booklet giving a description of the mechanism and action of their dry gas-meters. It contains twelve pages of letterpress and a large folding plate; and it will be found suitable for use in classes on "Gas Distribution." Messrs. Glover will send copies on application.

## USE OF TAR ON ROADS IN KENT.

We have received from Mr. H. P. Maybury, M.Inst.C.E., the Surveyor to the Kent County Council, his report for the year ended the 31st of March last, in which he gives the following particulars in regard to the use of tar for improving the surface of the roads in the county, in view of the motor traffic.

The mileage of roads in the rural districts is 576, and in the urban districts 20—a total of 596. The actual cost of maintenance, tar painting, and improvement work during the year was £94,253 15s.; being £715 17s. 10d. less than in the preceding year. Of this sum, £26,974 13s. 4d. was expended upon tar painting, widenings, kerbing, channelling, paving, and drainage works; representing £45·1 per mile. The cost of maintenance proper was, therefore, £112·8 per mile; being £11·8 per mile less than in the previous year. The tar-painting bill alone came to £20,594 3s.; 823,766 gallons of tar having been used upon 371 miles of surface. The area treated was nearly 5 million superficial yards. In addition to tar, 91 tons of special bituminous binding preparation, having asphalte as its base, was purchased; this costing £258 9s. 5d. Further, in the urban retaining districts the Council paid to the several authorities £4855 10s. 7d. for tar painting about 120 miles of road, representing 1,344,380 superficial yards; so that the total cost to the county fund of tar painting and kindred work was no less than £25,708 3s.

The total quantity of material put upon the directly maintained roads represented 117,531 tons or yards; being equal to 197 tons or yards per mile. This was less than in the preceding year; but Mr. Maybury says it is still an extremely large quantity—far above that used in almost any other county. Of the entire bulk of material used, 56,061 tons was granite and 12,529 tons Kentish rag tar macadam; the latter being an increase of 9801 tons over the quantity used in the preceding year. Mr. Maybury is pleased to be able to report that "if care is continued to be exercised in the preparation and laying of this material, good value to the county may be secured, and at the same time an important county industry assisted."

In the portion of the report dealing with administration, Mr. Maybury states that, notwithstanding the increase in the use of traction-engines, steam-lorries, and other self-propelled vehicles, the county roads have been maintained satisfactorily, and are much improved in strength; while the dust nuisance is almost a thing of the past. Upon the most important roads, and where the traction-engine and commercial motor traffic is greatest, he fears that the water-bound system and tar painting will have to give way to some more durable form of maintenance; and during the present year, with assistance from the Road Board, he is laying down several miles of granite macadam, grouting with a pitch matrix. He thinks it possible that this will be found, over a period of years, to be quite the cheapest form of construction to support the heavy vehicles.

## STREET LIGHTING IN SHOREDITCH.

At the meeting of the Shoreditch Borough Council last Tuesday, the Lighting Committee presented a report in which they recommended the adoption of electric lighting in all the streets north of Old Street. The number of gas-burners in the district referred to is 1055; and the capital cost of laying about 14 miles of cables in 160 streets is approximately £8385. The cost of converting the lamps is estimated at £665 5s. The proposed charge to the general rate is 37s. per 50-candle power per annum, including lighting and the maintenance of lamps, which compares with the present cost of 40s. 3d. per annum. An important reason for the change put forward by the Committee was that it will enable the laying of cables of sufficient size to deal with a demand for lighting and power which at present cannot be met.

Mr. PORTER moved an amendment that the scheme should be referred back to the Committee. He said he thought it involved too great an expenditure for the Council to give one decision upon, and hoped the Committee would bring up a smaller scheme, as this would enable them to avail themselves of the many changes that were taking place in lighting methods. The statement was made in the report that the scheme would result in a reduction in the cost of public lighting; but this was quite contrary to the past experience of the borough in this respect. At the present time they were paying £2 for every £1 previously paid for gas lighting. He quite admitted that there was more light; but, judging from the past, he was inclined to the view that the Committee would not keep the expense within the limits mentioned in the report. There was another important point—viz., that the result of the scheme, if carried through, would be less revenue from the Gas Company in the way of assessment; and if this were so, the rates would have to bear the loss.

The amendment having been seconded,

Mr. BIBBY supported it, and suggested that a quarter of the scheme should be undertaken at first. He said the Council had paid dearly for going into "the first mad scheme of street lighting."

Several councillors having spoken in support of the scheme,

The CHAIRMAN OF THE COMMITTEE, replying to the criticisms, said the first scheme of street lighting in Shoreditch was by arc lamps; whereas in the new one they would use metallic filament lamps. It would take about three years to carry out the complete change, and it would be made in sections. He thought the Committee would have sufficient common sense not to carry out any work unless they were convinced that they were doing it upon the best system. Therefore the argument that something better might be discovered before the change was completed did not apply, as, the work being done in sections, the Committee could avail themselves of all improvements. The assessment of the Gas Company would not be reduced, as they would not remove a single pipe from the district. The Committee stood by their figures, which were based upon the average number of hours the lamps would be alight. The charge was a fixed item.

Eventually the amendment was withdrawn, and the Committee's recommendation was adopted.

## LECTURES ON ILLUMINATING ENGINEERING.

### Syllabus of the Polytechnic Lectures.

In the "JOURNAL" for the 12th inst. (p. 663), it was announced that a course of twelve lectures on illuminating engineering had been arranged to be given at the Polytechnic, Regent Street, from Oct. 31 to Feb. 15 next. The lectures will be open to all who are interested in the subject: and the fee for the entire course will be 12s., or 2s. for single lectures. As some readers of the "JOURNAL" may be desirous of attending, we reproduce the syllabus.

ELECTRIC LIGHTING.

*Glow Lamps.*—Early history. General nature of electric supply. Variation in load, tariffs and basement rates, &c. Qualifications of a good glow lamp, efficiency, life, durability, &c. Carbon filament, Nernst, graphitized osmium, helium, tantalum, and tungsten lamps. Special problems in manufacture of tungsten lamps. Characteristic differences between carbon and metallic filaments. Effect of variations in voltage. Use of small transformers on lighting circuits. Low voltage lamps for signs, &c. Progress in making high-voltage low candle power units. Improvements in strength and durability. Drawn tungsten wire. Large candle power lamps for public lighting, &c.

*Arc Lamps.*—Nature of arc struck between carbon electrodes. Open arc lamps for direct and alternating current. Enclosed arc lamps. Flame arc lamps, characteristic distinctions from those using ordinary carbons. Colour, efficiency, burning hours, &c. Magnetite and Titanium arcs. Magazine arc lamps. Enclosed flame arc lamps (Jandus carbone, &c.). Miniature arc lamps. Devices for altering distribution of light ("Excello" dioptric globe, &c.).

*Vapour Lamps.*—Distinction between light from luminescent vapours and glowing solids. Mercury (Cooper-Hewitt) lamps, characteristic colour and efficiency. Quartz tube mercury lamps. Moore tube system. Effects of using nitrogen carbon dioxide, neon, &c. Value for colour matching. Phosphorescence and fluorescence. Future developments in electric illuminants.

GAS LIGHTING.

Early history of gas lighting. General nature of gas supply. Luminous flame burners, flat-flame, argand, albo-carbon, and regenerative systems. The bunsen burner and its application to incandescent lighting. Various systems of incandescent gas lighting, upright, horizontal, inclined, and inverted mantles, and their relative advantages. Qualities requisite in a good mantle, and methods of determining them. "Shocking" machines. Packing and transport of mantles. Progress made in regard to improvements in mantles. Colour of light from mantles. Use of non-collodionized mantles. Materials used in the manufacture of mantles, ramie and artificial silk. Efficiency of modern methods of lighting by gas. Adjustment of burners. Supervision and maintenance of installations.

Various types of burners. Self-intensified systems of gas lighting and the production of high-power units at ordinary district pressures. Recent progress. High-pressure systems—viz., high-pressure air, high-pressure gas, and high-pressure gas-air mixtures. Modern high-power units. Use of multiple-burner units for various purposes and their advantages. Centrally suspended street lamps, and means for raising and lowering for cleaning and maintenance. Automatic control of public and other lamps, various appliances, clockwork and pressure-wave systems of control. Distance control for indoor lighting, various systems, electric, pneumatic, &c. Self-lighting mantles and pyrophoric igniting appliances. Effects of calorific power of gas, shape of flame, pre-heating, and flame temperature. Modern problems in gas lighting, and future prospects. Calorific and illuminating power standards.

OIL, PETROL AIR GAS, ACETYLENE, &c.

Oil-lamps, conditions of efficiency and safety, value for private house lighting. Incandescent oil systems and their application to lighthouses. Incandescent paraffin and spirit lamps. Liquid gas, petrol air-gas systems. Acetylene lighting. Modern generating plants. Conditions for safety and efficiency. Types of burners. Portable lamps for mines. Flare lights. Dissolved acetylene. Application to railway and marine lighting. Automatic valves for buoys, &c. Use of above systems for emergency lighting and in remote districts, in the Colonies, &c.

ILLUMINATION FROM THE STANDPOINT OF THE EYE.

The anatomy of the eyeball, including the structure of the media and of the retina. The pupil reflex and the ascertained reactions of the eye to luminous stimuli. Fechner's law. Photometry in its physiological aspects. Relationship of illumination and visual power. Effects of over and under stimulations. Glare. Fatigue. Illumination as a hygienic requirement in school life, in home surroundings, in industrial occupations.

THE MEASUREMENT OF LIGHT.

Early ideas on photometry. Meaning of "candle power." Power of creating brightness and revealing detail, penetrating power, &c. Standards of light and their development. The international unit. Co-operation between British, Continental, and American laboratories. The photometer-room. The photometric bench. Practical precautions to secure accuracy. Sensitiveness of the eye and various photometers, grease spot, Joly, Lummer-Brodhun, flicker, &c. The problem of comparing lights of different colour. Studying distribution of light. Mean spherical candle power. Ulbricht globe and integrating photometers. Commercial and laboratory accuracy. Practical value to consumer and lamp maker. Buying and selling light.

ILLUMINATION AND ITS MEASUREMENT.

Value of illumination measurements in practice. Early forms of illumination photometers. Trotter, Harrison, Martens, Sharp and Miller, holophane, lumeter, and other apparatus. Measurement of surface brightness and reflecting power. Practical applications, testing wall papers, cinematograph screens, &c. Measurements in factories, schools, libraries, &c. Street lighting photometry and street lighting contracts.

SHADES AND REFLECTORS.

Recapitulation of effect of light on the eye. Intrinsic brilliancy of various illuminants. Glare, its effects and avoidance. Practical illustrations in street, school, and shop lighting. Methods of screening illuminants. Indirect and direct lighting. Effects of shadow. Functions of shades, globes, and reflectors. The scientific distribution of light.

COMPARISON OF DAYLIGHT AND ARTIFICIAL LIGHTING.

Requirements of good illumination. Window space in interiors. Measurement of daylight. Ancient light problems. Applications in schools, factories, &c. Effect of wallpapers on day and artificial illumination. Planning the lighting installation and calculations of illumination beforehand.

COLOUR OF ARTIFICIAL ILLUMINANTS.

Comparison with daylight. Methods of testing colour. White lights. Methods of producing artificial daylight. Combinations of illuminants and use of special screens, &c., to imitate daylight. Application to silk-mills, dyeing-works, flower-shows, &c. Æsthetic aspects of colour. Theatre and spectacular lighting and scenic displays. Efficiency of modern illuminants and the production of invisible rays. Effects of ultra-violet light in causing the fading of colours, destruction of bacteria, &c. Fluorescence and phosphorescence and their use in producing special colour effects.

PRACTICAL LIGHTING PROBLEMS.

Examples of good and bad lighting in schools, libraries, factories, shops, offices, &c. Desk and table lighting. Problems in modern street lighting, and the proposed standard specification. Summary and conclusions.

## STATISTICS OF WATER UNDERTAKINGS.

### Extracts from the Census of Production Returns.

In the "JOURNAL" a fortnight since some statistics were given relating to the gas undertakings of the United Kingdom, extracted from the recently-issued Blue-book containing the conclusion of the series of preliminary tables summarizing the results of the returns made under the Census of Production Act, 1906. We may now give particulars in regard to the water undertakings, which apply normally to the year 1907.

The tables are based on returns received in respect of water-works undertakings owned by companies (including hydraulic power companies) and public authorities. Private water-works owned by manufacturers, brewers, &c., for the supply of water for their own purposes are not included. The returns received in respect of the water-works at the Royal Arsenal and Royal Dockyard, Woolwich, are included with those received from local authorities in the tables relating to public authorities. Separate tables are given showing the particulars furnished in respect of the undertakings owned by companies and by public authorities.

Companies and authorities were directed to state as to the selling value of the water supplied (*a*) the net amount charged, less discounts, to private consumers, whether the charge was levied by rate or as rent or in any other way; and (*b*) the actual amount charged in the case of water supplied to another department of a local authority. Contributions from the local rates to make up any deficiency in the income of water-works undertakings are not included.

The total sum returned as the value of water supplied by companies and public authorities is £10,465,000, and in addition £144,000 was received from consumers for the fixing of meters, pipes, fittings, &c. Certain companies and local authorities purchased from other companies and public authorities water in bulk for distribution; and the sellers as well as the distributors included the price received in the value of their output. In the cases in which such duplicate entries have been identified, the value of the water thus supplied in bulk is estimated at about £109,000. Allowing for this duplication, the total value of the water supplied was about £10,356,000; and adding the amount (£144,000) received from consumers for fixing fittings, &c., the total output of water-works undertakings was about £10,500,000. In addition, the value of the water sold by railway companies, and included in a previous section of the preliminary tables under the heading of "other manufactures and work done," was £41,000; raising the total value of the water supplied in the United Kingdom in 1907, so far as returned to the Census of Production Office, to about £10,397,000.

Under the limitations imposed by the Census of Production Act, it was not possible to require in the compulsory part of the schedule a statement of the quantity of water supplied to consumers. A voluntary question was accordingly included in the schedule, requesting companies and local authorities to furnish information respecting the quantity of water supplied.

Companies and public authorities that supplied water to the value of £9,592,000 (or 91·7 per cent. of the aggregate value of the water supplied) stated that the quantity supplied by them was nearly 371,000 million gallons, or about 365,000 million gallons after deduction of water bought by one undertaking from another and returned by both. It may be estimated that the total quantity of water supplied by water undertakings was about 400,000 million gallons. No information is available as to the quantity of water supplied without special charge by a number of the smaller authorities or obtained from public wells.

The net output of all the water-works undertakings covered by the report was £9,052,000, this sum representing the total amount by which the value of the output of such undertakings, taken as a whole, exceeded the cost of the materials used in connection therewith and of water purchased in bulk. The actual cost of such materials was about £1,448,000, and that of water purchased in bulk about £109,000.

The average number of persons employed by water-works under-

takings on the four days for which the numbers were returned was 22,059—viz., 18,505 wage-earners and 3554 salaried persons.

### Details as to Companies.

The total value of the water supplied by companies, including hydraulic power companies, is returned as £2,148,000. This sum includes the selling value of water purchased in bulk for distribution at the cost of about £22,000, of which water valued at about £20,000 was purchased from local authorities, and water valued at about £2000 was purchased from other companies. The latter sum involves duplication to this amount; so that the net value of the water supplied by companies is reduced to £2,146,000. In addition, £24,000 was received from consumers for fixing meters, fittings, &c. (exclusive of the cost of the meters, &c.); raising the value of the total output of water-works undertakings owned by companies to £2,170,000.

Companies that supplied water to the value of £1,747,000 (or about 81·3 per cent. of the aggregate value of the water supplied by companies) stated that the quantity supplied was 68,057 million gallons, of which about 850 million gallons were purchased in bulk from public authorities. Deducting about 50 million gallons bought by various companies from others and returned by both, the quantity of water distributed by the companies furnishing this information (including water sold in bulk to local authorities) was about 68,000 million gallons.

The working staff of water-works companies is not employed solely in the operation of the water-works, but also in works of construction, alteration, and repair in connection with the reservoirs, wells, aqueducts, mains, machinery, plant, &c. The cost of such work, whether immediately met out of capital or out of revenue, forms eventually a charge on the value of the water supplied. Consequently, it has not been taken as an addition to the "output" of water-works undertakings, in the meaning in which that term has been used for the purposes of the census. A summary of the particulars furnished in respect of the cost of such work done in the censal year (covering wages, materials, and establishment charges attributable to the work) is shown below; work given out to contractors not being included.

| | Construction. | Alteration and Repair. | Total. |
|---|---|---|---|
| Work done by employees of companies— | | | |
| Water-works (including reservoirs, wells, aqueducts, conduits, mains from reservoirs, street mains, &c.) | £234,000 | £174,000 | £408,000 |
| Buildings in connection with water-works | 12,000 | 9,000 | 21,000 |
| Machinery and plant in connection with water-works | 8,000 | 53,000 | 61,000 |
| Work not separately distinguished | 57,000 | 12,000 | 69,000 |
| Total cost of work done | £311,000 | £248,000 | £559,000 |

In addition, the value of works of construction, alteration, and repair of water-works, works, &c., carried out by builders and contractors, was returned as £1,802,000; and the cost of such work carried out by railway companies was £155,000.

The net output of the water-works undertakings conducted by companies was £1,727,000; this sum representing the total amount by which the selling value of the water supplied exceeded the cost of water purchased and the cost of the fuel and other materials used in pumping and distributing the water, and in the execution of works of construction, alteration, and repair. After elimination of the cost of water purchased by one company from another and returned by both, the actual cost of materials used and of water purchased from local authorities was about £443,000.

The average number of persons employed on the last pay-days in January, April, July, and October in connection with water-works undertakings conducted by companies is returned as 4716—viz., 3714 wage-earners and 1002 salaried persons; the total number being distributed by age and sex as follows: Males under 18, 105; over 18, 4584. Females under 18, none; over 18, 27.

### Details as to Public Authorities.

The tables are based on returns received from local and other public authorities in respect of water-works undertakings conducted by them for the sale of water for private and public purposes. Cases where the local authority control the supply of water, but do not charge for it (the cost being met out of the general rate), are not included in the tables; but the expenditure of the local authority in works of maintenance of the service is included.

The total value of the water supplied by public authorities is returned as £8,317,000. This sum includes the selling value of water purchased in bulk for distribution at the cost of about £87,000, of which water valued at about £9000 was purchased from companies, and water valued at about £78,000 from other public authorities. This latter sum involves duplication to this amount; so that the net value of the water that was supplied by local authorities is reduced to about £8,239,000. In addition, £120,000 was received from consumers for fixing meters, pipes, fittings, &c. (exclusive of the cost of the meters, &c.); thus raising to about £8,359,000 the value of the total output of water-works undertakings conducted by public authorities.

Public authorities who supplied water to the value of about £7,845,000 (or 94·3 per cent. of the aggregate value of the whole) stated that the quantity supplied was 302,703 million gallons, of which 300 million gallons were purchased in bulk from companies. Deducting about 4100 million gallons bought by various public authorities from others and returned by both, the quantity of water distributed by these authorities, including water sold to companies, was 298,600 million gallons.

As has already been explained in the case of companies, the working staff of the undertakings of public authorities is engaged not only in operating the water-works, but in works of construction, alteration, and repair in connection with the reservoirs, wells, aqueducts, mains, machinery, plant, &c. The cost of such work has not been taken as part of the output of the undertakings, but a summary of the particulars


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furnished in respect of the cost of such work (covering wages, materials, and establishment charges attributable to the work) is shown below; work given out to contractors not being included.

| | Construction. | Alteration and Repair. | Total. |
|---|---|---|---|
| Work done by employees of public authorities— | | | |
| Water-works (including reservoirs, wells, aqueducts, conduits, mains from reservoirs, street mains, &c.) | £533,000 | £836,000 | £1,369,000 |
| Buildings in connection with water-works | 10,000 | 12,000 | 22,000 |
| Machinery and Plant in connection with water-works | 16,000 | 50,000 | 66,000 |
| Work not separately distinguished | — | — | 417,000 |
| Total cost of work done | | | £1,874,000 |

In addition, the cost of the work done by local authorities in maintaining the service of water where the water was supplied free amounted to £19,000.

The net output of the water-works undertakings conducted by public authorities was £7,325,000; this sum representing the total amount by which the value of the water supplied exceeded the cost of water purchased and the cost of the fuel and other materials used in pumping and distributing the water and in the execution of works of construction, alteration, and repair. After allowing for the cost of water purchased by one public authority from another and returned by both, the actual cost of materials used and of water purchased from companies was about £1,034,000.

The average number of persons employed on the last pay-days in April,* July, and October, 1907, and January, 1908, in connection with water-works undertakings conducted by public authorities was 17,343—viz., 14,791 wage-earners and 2552 salaried persons; the total being distributed by age and sex as follows: Males under 18, 286; over 18, 16,962. Females under 18, 1; over 18, 94.

* April, 1908, in the case of local authorities in Scotland.

## NOTES FROM SCOTLAND.

### From Our Own Correspondent.

*Saturday.*

The valuation appeal case to which I referred last week as about to be heard in the Edinburgh Valuation Court was reached last evening; and an opening statement was made by Mr. J. Duncan Millar, on behalf of the Gas Commissioners, who are the appellants. The case is, however, in the unfortunate position of being only partly heard, which takes away from the interest of it. Mr. Millar's statement was to the effect that the Commissioners were asking the Court to lay down and follow out the principles which were laid down by the Valuation Appeal Court in the Gas Commissioners' appeal in 1909. The Assessor had gone so far in carrying out these principles, but not far enough, because on this occasion he had refused to deduct from the expenditure, in order to arrive at the valuation figure, feu-duties amounting to £259, and landlords' proportion of rates and taxes, amounting to £7819. In the case of a non-profit earning undertaking, such as that of the Gas Commission, a rule had been laid down—an artificial rule, he admitted, but still a necessary one—and it was upon the application of this that the appeal had been brought, so that the Court might decide that the rule must be applied, and applied fully, in this case. The Assessor, when deducting expenditure, ought to have deducted the whole expenditure. For the first time the Commissioners had been allowed Parliamentary and voluntary expenses. The total reduction claimed by the Commissioners in the city, in the burgh of Leith, and in the county of Midlothian, amounted to £8282. This would mean a saving of £1500 a year to the Gas Commissioners, which eventually would be a saving to the gas consumers. The case for the Assessor has yet to be heard. The decision in the Leith case, which was mentioned last week, has not yet been given.

The need of publicity cannot be better emphasized than by giving one or two quotations from a special article which was published in the "Dundee Advertiser" on Thursday of this week, under the captivating heading of "Light and Heat in the Home." The writer commences with a number of "useful hints" as to the reflective capacities of wall papers, and then goes on to say: "It is not the intention to discuss the merits of any particular form of illumination. The controversy between gas and electricity is largely a commercial one; gas having the advantage in respect of small property by reason of its greater age. The difficulty of getting electric light into this class of property is one of wiring; and until houses can be wired free, as is now the case with gas, no considerable progress can be anticipated. Gas users may be warned that hissing and flaring gas is bad. The unburnt gas which escapes in this manner is very dangerous, and may contain as much as 6 per cent. of the poisonous carbonic oxide. Another development which will benefit gas users considerably is now being worked out in London. This has for its object the maintenance of a steady pressure, which will do away with the need for gas regulators or burners, and enable the manufacture of gas-fittings for the pressure which each particular gas authority guarantees. The fitting of pressure regulators on meters will follow." Gas for lighting, it is to be observed, is not condemned, but is even admitted to have some advantage. This is, however, followed by a dreadful warning, and by the foreshadowing of costly appliances which it will be necessary to use. A good word is said for inverted incandescent gas lighting. Then the same service is rendered to the metallic filament electric lamp; and the author lays down the dictum that "from the hygienic standpoint electricity is much the more preferable form of lighting, and its general introduction would mean an improved standard of public health, with the other desirable features which follow in its train." A well-written article, balancing the *pros* and *cons* of the rival luminants in quite a dexterous fashion, but taking care, in the end, to see that the balance is on the side which the writer mani-

The "Adams."

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festly leans to. With such things going on in support of electricity, it is time that something was being done to bring the merits of gas for lighting and heating better before the community.

Another article which was published in the "Dundee Advertiser" this week, and which bears the impress of local origin, is to the following effect: "The people of Dundee have been slow to recognize the value of coke as house fuel. They lag behind many other communities in this respect. Still, they are now showing a growing partiality for it, and no doubt Dundee will soon take its proper place as a coke-consuming city. This state of matters is not due to any lack of supply, but to the failure of the citizens to avail themselves of the opportunity afforded for obtaining fuel both cheap and good. The Gas Commissioners produce from their works over 50,000 tons of coke annually, and the excess over local requirements has either to be shipped or sent by rail to other parts where the surplus can easily be disposed of. Bakers and tradesmen with heating installations in their premises were quick to recognize the economies which coke enabled them to effect. They were ahead of householders, who, practically five years ago, began to appreciate its value. The Gas Commissioners then agreed to give those small customers as much coke for 2d. as they could carry away with them, and in December last 5739 twopences were taken at the gas-works; no fewer than 414 men, women, boys, and girls, armed with bags, baskets, and barrows, being supplied on the last day of the year. An explanation of the dilatoriness of the Dundee householder in this respect is that in the tenement properties the bunker accommodation is exceedingly limited, and has not capacity for both coal and coke; the former being necessary to set the fire going. Coke is also finding its way into the houses of the better classes, who can purchase it at 12s. a ton *plus* cartage. It is extremely suitable for kitchen ranges, and mixed with small, cheap coal it generates more heat than the same quantity of ordinary household coal. Anxious to encourage the demand, the Gas Commissioners have adopted the policy that where the gas-producing properties of two kinds of coal are equal, and the prices are also similar, that giving the heating quality of coke is chosen. No doubt in a short time the demand from Dundee for all purposes will exceed the 15,000 tons about which it at present stands."

On Thursday, an inquiry was held in the Sheriff Court at Haddington into the circumstances attending the death of James M'Callum, gamekeeper at Newton Hall, East Lothian. M'Callum had charge of a petrol-gas plant. On the evening of Aug. 25, the gas was not satisfactory in the house, and M'Callum went to see to it. Just after he went out of the house the explosion occurred, and M'Callum was found lying about 20 feet away from the door of the gas-plant house. He was severely injured, and died on the 1st inst. Previous to his death, he stated that, before going into the chamber he heard a gurgling of water, and opened the door about 5 inches in order that he might see the engine. The explosion then occurred. He did not know what caused it, as he had not struck a light. Evidence was led to establish that there must have been an escape of gas, and a light, before the explosion could have occurred. The cause of the explosion remains a mystery; the verdict containing no finding upon this point.

## CURRENT SALES OF GAS PRODUCTS.

**[For Table of "Tar Products Prices," see p. 828.]**

LIVERPOOL, *Sept.* 23.

**Sulphate of Ammonia.**

Although the demand has been fairly well maintained throughout the week, the upward movement which appeared ten days ago has not shown any further development. There has been rather a paucity of new business direct from consumers; but the requirements have still been sufficient to absorb current production without any material setback. At the close, the nearest values for prompt delivery are: £13 17s. 6d. to £13 18s. 9d. per ton f.o.b. Hull; £13 18s. 9d. to £14 per ton f.o.b. Liverpool; and £14 1s. 3d. to £14 2s. 6d. per ton f.o.b. Leith. In the forward position no further first-hand business has transpired. Makers continue to quote £14 5s. per ton. f.o.b. principal ports for equal monthly quantities October-March or January-June; but it is reported that dealers are offering abroad at prompt price.

**Nitrate of Soda.**

The market for this article remains very steady, and values are well maintained at 10s. per cwt. for ordinary and 10s. 3d. for refined quality, on spot.

LONDON, *Sept.* 25.

**Tar Products.**

Markets for tar products still remain steady. Pitch is practically unchanged. Benzols are firm, with a fair amount of inquiry. Solvent naphtha is steady, and there has been a little more inquiry for this article. There is nothing fresh to report concerning crude carbolic. Creosote is firm, and a considerable business has been done at improved prices.

The average values during the week were: Tar, 21s. to 25s. *ex* works. Pitch, London, 40s. 6d. to 41s. 6d.; east coast, 40s. to 41s.; west coast, Manchester 39s. 6d. to 40s. 6d., Liverpool 40s. to 41s., Clyde 40s. to 41s. Benzol, 90 per cent., naked, London, 8¾d. to 9d. f.o.b., North, 8½d. to 9d. f.o.b.; 50-90 per cent., naked, London and the North, 7¾d. to 8d. f.o.b. Toluol, naked, London, 8½d.; North, 8d. to 8½d. Crude naphtha, in bulk, London, 4d. to 4½d.; North, 3½d. to 3½d. Solvent naphtha, naked, London, 9¼d. to 9½d. f.o.b. North, 8d. to 8½d. f.o.b. Heavy naphtha, naked, London, 10¼d. to 10½d. f.o.b.; North, 9d. to 10d. f.o.b. Creosote, in bulk, London, 2 5/16d. to 2⅜d.; North, 2⅜d. to 2½d. Heavy oils, in bulk, 2⅞d. Carbolic acid, casks included, 60 per cent., east coast, 2s. to 2s. 2d.; west coast, 1s. 11d. to 2s. 1d. Naphthalene, £4 10s. to £9 10s.; salts, 42s. 6d. to 45s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

**Sulphate of Ammonia.**

Although there has been a little more inquiry for this article during the past week, it has had no effect on prices; and in the majority


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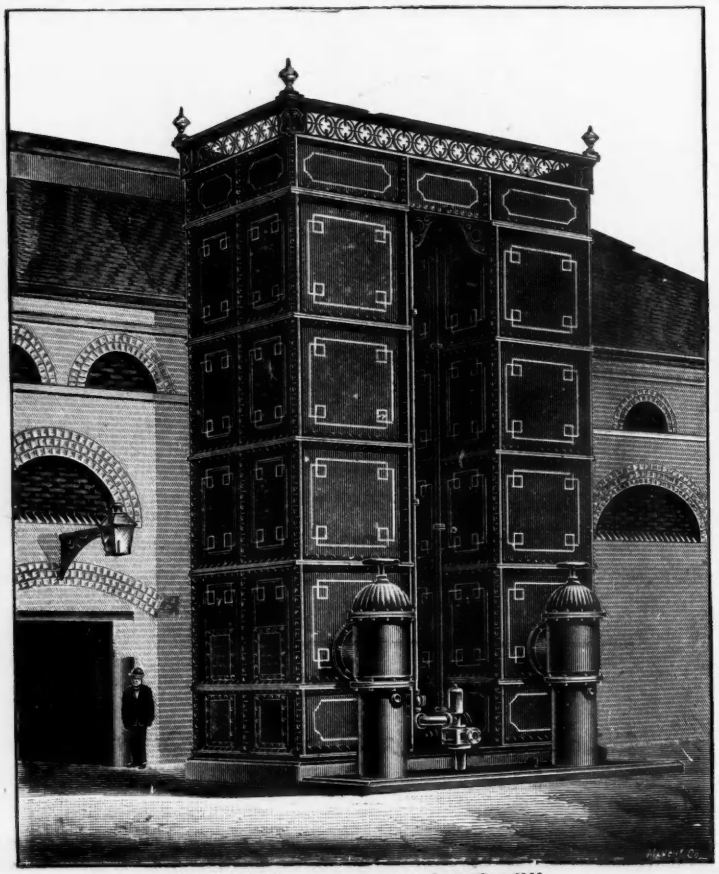

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**WALKER AND WALLSEND**
**and other Works.**

of cases buyers are still holding out. Actual Beckton is quoted at £13 15s.; but outside London makes could be purchased in the neighbourhood of £13 7s. 6d. to £13 10s. Hull, £13 18s. 9d. to £14; Liverpool, £14. Leith makers are still holding out for £14 5s., but nominally the value is not more than £14 to £14 2s. 6d. at this port. Middlesbrough, £13 18s. 9d. to £14.

## COAL TRADE REPORTS.

### Northern Coal Trade.

There is a stronger demand in the Northern coal trade, and prices of some kinds are higher. Best Northumbrian steams are from 11s. 6d. to 11s. 9d. per ton, second-class steams are 9s. 6d. to 10s., and steam smalls are quiet at from 4s. 9d. to 6s. The demand is full, for best qualities, and the prices are firm; the shipments being rather pressing for the rest of this month. The output of gas coals is heavy, and meets the requirements, so that there is not much alteration in the values quoted. Prices are based on about 10s. 9d. per ton f.o.b. for best Durhams, and 9s. 6d. to 10s. for second-class coals. "Wear" specials are near 11s. 6d. per ton f.o.b. There is a steady demand for gas coals. The tenders have been sent in for the supply of gas coals for Gothenburg—30,000 tons for next year—and it is expected that the result will be known in about a week. Some further sales are spoken of for the Mediterranean ports; and from 17s. 3d. to 17s. 6d. per ton delivered is spoken of as a possible price. In the coke trade, the tone is steady; but gas coke now shows a larger output, and is slightly easier at 14s. 3d. to 14s. 6d. per ton f.o.b.

### Scotch Coal Trade.

The foreign trade, chiefly for ell, continues to be strong. Splint is also in demand. Prices, even for small sorts, are advancing. The quotations are: Ell, 9s. 9d. to 10s. 6d. per ton f.o.b. Glasgow; splint, 10s. 6d. to 10s. 9d.; and steams, 9s. 3d. to 9s. 6d. The shipments for the week amounted to 354,208 tons—a decrease upon the preceding week of 36,241 tons, but an increase upon the corresponding week of 31,581 tons. For the year to date, the total shipments have been 11,575,985 tons—an increase upon the corresponding period of 123,166 tons.

**Mellor (Derbyshire) Water Supply.**—The Mellor Rural District Council have decided to apply to the Local Government Board for sanction to borrow £6900 for water-works purposes. At present there is no public water supply for the town and district, and the people have had to rely upon wells and other private sources. Of the £6900, a sum of £3600 is for the purchase of the present water-works belonging to Mr. Arkwright, and £3300 for augmenting the supply from springs on that gentleman's land at Cobden Edge.

### Minimum Wage Agitation at Newcastle.

A mass meeting was held on Sunday morning, in the Collingwood Hall, Newcastle-on-Tyne, of the labourers employed in the distribution department of the Newcastle and Gateshead Gas Company, together with the pipe-layers, who are members of the National Amalgamated Union of Labour. The men are agitating for a minimum wage; and it was agreed that their applications should be forwarded to the Company for consideration. The labourers in the distribution department ask for a minimum wage of 26s. 6d. per week, which is, it is stated, the same as is paid at the Elswick and Redheugh works of the Gas Company; and the pipe-layers are asking the Company to consider an application for a minimum wage of 35s. per week. The latter contend that, to all intents and purposes, they are skilled workmen. Their wages vary between 27s. and £2 and upwards per week; and they consider 35s. a week a legitimate minimum to ask for.

**Proposed Water-Works Purchase at Stoke-on-Trent.**—Conferences of the local authorities interested have been held to discuss the advisability of a joint purchase of the undertaking of the Staffordshire Potteries Water-Works Company; and, as a result, the Water Committee of the Stoke-on-Trent Corporation have decided to recommend the Council to enter into negotiations to acquire the concern. The matter will come before the next meeting of the Council.

**Gas-Workers' Wages at Birmingham.**—A petition has been presented to the Birmingham Gas Department, through the Amalgamated Society of Gas Workers and General Labourers, asking for an increase of wages for men of all grades and a revision of holidays. The advance asked for varies from 4d. to 7d. per day for workers in the retort-house, and an equivalent of 2s. per week for all labourers. Application is also made for a week's holiday annually for all men regularly employed, in addition to the Bank Holidays; and holidays for short service men *pro rata*. The advances are asked for by reason of the increased cost of living, and of the new methods of gas manufacture adopted, which it is stated justify a revision of wages.

**Keighley Gas Accounts.**—The Keighley Town Council last Tuesday had before them the accounts and report of the Gas Committee for the past financial year. The gross receipts amounted to £17,848; and after making allowance for the payment of all charges, there was a net profit of £9133. Provision was made for the transfer of £6444 to the general district rates, leaving a balance of £2689. This, with £5531 brought forward from last year, made the total surplus £8220. Mr. J. Harrison, the Chairman of the Committee, moved that the transfer to the rates be approved, that £50 be handed over to the Victoria Hospital, and that the surplus balance be carried forward. He pointed out that the net profits had increased by £640, despite a reduction of 1d. per 1000 cubic feet in the price of gas. The Committee hoped, he said, to still further reduce the price. The recommendations were approved.


# "ST. NICHOLAS"

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## An Important Advantage

(quite distinct from its cheerful appearance) that this fire has over the inset fires which are being introduced this season is that it can be fitted without having to remove the existing bottom bars of the interior.

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WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
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## New Catalogues, &c.

We have received from Messrs. Sawer and Purves the new edition of their catalogue and price list of wet and dry gas-meters. It consists of four sections—the first being devoted to gas-meters; the second, to test holders, governors, and gauges; the third, to main-taps, brass fittings, and gas-fitters' tools; and the fourth, to steam and water fittings, lamps and lamp-columns, and sundries. These are followed by tables and other useful information. The illustrations and particulars of the firm's manufactures occupy about 120 large quarto pages; and they are preceded by views of the works. The book is quite an artistic production. Another catalogue which has just come to hand is that of the New Inverted Incandescent Gas-Lamp Company, Limited, containing illustrations and particulars of the "Nico" inverted incandescent gas-burners, mantles, gas-fittings, arc lamps, and accessories, in great variety. The Bland Light Syndicate have sent us their new season's catalogue, which is very comprehensive. It shows not only the several types of Bland inverted burners, "Blanlite" indoor and outdoor lamps, Bland-Graetzin lamps, and upright and inverted mantles, but a large collection of brackets, pendants, hall-lamps, brass fittings, tools, &c. We have received from Messrs. Robert Boby, Limited, of Upper Thames Street, E.C., an illustrated pamphlet containing particulars of their "Neckar" patent water-softening and boiler mud extracting apparatus, which combines purification of water by filtration with softening by admixture with a reagent, and the automatic removal from the boiler of the deposit produced during the evaporation of the softened water.

**Gas-Workers' Wages at Rochdale.**—The Works Sub-Committee of the Rochdale Corporation Gas Committee have postponed for a month the consideration of an application made by the Gas-Workers' and General Labourers' Union for advances in pay to various classes of employees engaged at the gas-works.

**Gas Exhibition at Airdrie.**—A comprehensive exhibition of gas appliances was opened in the Memorial Hall, Airdrie, N.B., on the 13th inst., and proved a source of great attraction to the townspeople, who visited it in large numbers. Some beautiful examples of gas-stoves, the latest types of burners, hot-water heaters, and trade appliances utilizing gas, were shown; the exhibitors being Messrs. Ewart and Co., Messrs. Falk, Stadelmann, and Co., Messrs. Fletcher, Russell, and Co., Messrs. R. & A. Main, Messrs. James Milne and Son, Messrs. Parkinson and W. & B. Cowan, the Richmond Gas Stove and Meter Company, Messrs. J. & W. B. Smith, and Messrs. John Wright and Co. Cookery lectures were given by Miss E. M. Dodds, late Principal of the Dundee School of Cookery, and they drew a large number of ladies; special features of attraction being the demonstrations of paper-bag cookery. Laundry work was done by Misses Bryden and Darling, of Glasgow. So great was the interest shown in the exhibition, that the Gas Committee decided to continue it for three days longer than was originally intended.

**Seaford Public Lighting.**—At a recent meeting of the Institution of Municipal Engineers, at Lewes and Seaford, Mr. Boyd A. Miller, the Engineer and Surveyor to the Seaford Urban District Council, read a paper on the drainage and sanitary administration of the town. In the course of it he referred to the public lighting, the gas for which is supplied by the Seaford Gas Company, Limited. The District Council have 173 lamp-posts, which were formerly supplied with gas through a meter fixed in each post. There is now a wet meter fixed to 22 of the lamps; and from this the whole are averaged. The Council pay 3s. 10d. per 1000 cubic feet for the gas consumed. The lamps are lighted, cleaned, and repaired by the Council's staff. The Welsbach "C" bye-pass burner, with globe and metal top, is used, owing to the high winds with which the town is visited. Gun-fire controllers are employed in the outlying districts.

**A Progressive Lincolnshire Gas Company.**—For a small concern making only about 8 million cubic feet of gas per annum, and situated a long distance from the coalfields, the Holbeach Gas Company, Limited, are showing a commendable determination to be progressive. The Chairman (Mr. Robert Merry) has lately circularized the consumers on the subject of obtaining the utmost value for the amount they spend on gas, which can best be done by using incandescent burners. These, however, he points out, must be kept in proper order; and therefore someone has been engaged to call periodically upon the consumers, advise them as to their fittings, and attend to their burners free—charging only for the renewal of mantles, which are supplied by the Company. The new official has been well received by all but some tradespeople who have hitherto done the work. As a further step forward, the Company have reduced the price of gas from 4s. 2d. to 3s. 9d. per 1000 cubic feet, as from the 1st inst.

**Bexhill Water and Gas Company.**—The report for the half year to June 30, to be presented at the meeting of the Bexhill Water and Gas Company on Thursday., states that the accounts show a balance at the credit of profit and loss, and available for dividend, of £4967. The Directors recommend that a dividend be declared for the six months at the rate of 6 per cent. per annum on the capital of £34,000 authorized by the Acts of 1885 and 1892, and at the rate of £4 4s. per cent. per annum on the capital of £114,570 authorized by the Act of 1896, Order of 1901, and Act of 1904, less income-tax. This, with provision for income-tax, will absorb £3426, leaving £1541 to be carried forward to the next account. The fact that the Hastings Corporation had deposited a Bill in Parliament which, in the opinion of the Directors, would have seriously affected the Company's rights, was referred to in the last half-yearly report; and it was stated that the Directors had lodged a petition in opposition thereto. This opposition resulted in obtaining for the Company protective clauses of great and permanent advantage. During the past half year, the yield of water from the several sources of supply has continued satisfactory; and the considerably increased demands made upon the resources of the Company, owing to the phenomenal drought during the present summer, have been successfully met.


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STILL ANOTHER HIT.

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**The Reduction in Gas Charges at Radcliffe.**—As was stated recently, the Directors of the Radcliffe and Pilkington Gas Company have decided to make a further reduction in the price of gas, to come into force after the inspection of the meters at the end of the current quarter. The following is the scale of net prices that will then obtain, according to the notice issued by Mr. James Braddock, Manager and Secretary to the Company: When the quarterly consumption is under 250,000 cubic feet, 2s. 9d. per 1000 cubic feet; 250,000 feet and under 500,000 feet, 2s. 8d.; 500,000 cubic feet and over, 2s. 7d.; for gas-engines and certain trade purposes, 2s. 4d.; for large users, 2s. 1d. There will also be a reduction in the price of gas supplied through prepayment meters.

**Proposed Purchase of the Ashbourne Gas-Works by the District Council.**—At an adjourned meeting of the Ashbourne District Council on Monday last week, it was decided that the members should go into committee for the consideration of the gas question, and to hear the opinions of Mr. Woolley, Solicitor, of Derby, and Mr. J. F. Bell, the Engineer of the Derby Gas Company, both of whom were in attendance. Mr. Woolley explained the effect of the Council's opposition to the Ashbourne Gas Company's Bill, and answered questions bearing upon the proposed purchase of their undertaking. Mr. Bell said he had visited the gas-works that day, and also replied to several interrogations put by the members. On the Council resuming as an ordinary meeting, it was proposed that proper notice be issued, under the Borough Funds Act, 1872, calling a Council meeting for the purpose of passing a resolution to deposit a Bill in Parliament for the purchase of the business of the Company.

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The Directors of the Monte Video Water-Works Company, Limited, have declared an interim dividend of 6 per cent. per annum, tax free, on the 37,500 old shares, for the half year ended the 30th of June.

The assessment of the Coventry Corporation gas undertaking for poor and district rate purposes has just been increased by £1000. The Gas Committee have decided that no objection shall be raised to the higher figure.

The Directors of the Consolidated Water-Works Company of Rosario, Limited, have declared an interim dividend of 6 per cent. per annum, free of tax, on the 25,000 old ordinary shares, for the half year ended the 30th of June.

One of the results of the strike at the Lancashire and Yorkshire Railway Company's works at Horwich has been that gas is being installed at the Railway Institute there, to take the place of the electric light, the current for which was supplied from the works.

The Burgess Hill Urban District Council have decided to support the local Water Company in their opposition to the scheme of small holdings now being promoted by the East Sussex County Council; danger being apprehended as to the pollution of the water supply from Whitelands, Ditchling.

The Coventry Corporation have applied to the Local Government Board for their sanction to a loan of £10,000 for extensions of watermains. The Board have authorized the raising of £6000, repayable in thirty years; this sum being the amount estimated, on the basis of past expenditure, to be required for the next three years.

An application has been made by some of the workmen of the Hebden Bridge and Mytholmroyd Gas Board asking for a full week's holiday and pay in each year, and cessation of work at 12 o'clock noon on Saturdays, instead of 1 o'clock as heretofore. The Manager was asked to make inquiries as to what other companies and corporations are doing in the matter.

The profits of the Glenboig Union Fire-Clay Company, Limited, including £1749 brought in, amount to £27,347. The Directors recommend that £4000 should be set aside for depreciation, £3000 written off the cost of new electric plant, and a dividend of 10 per cent., together with a bonus of 2½ per cent., paid, both free of tax—leaving £1597 to be carried forward.

The Society of British Gas Industries met on Little Aston Golf Course, Birmingham, on Friday, the 15th inst., by invitation of the Chairman of the Council (Mr. H. James Yates), to take part in a golf competition for a large silver cup presented by Mr. Yates to the members of the Society. There was a good attendance of members; and a very enjoyable time was spent on the links—the members being entertained to luncheon by Mr. Yates at the Golf Club House. The cup, which was won by Mr. P. B. de Clegg Mellor (of Messrs. John Hall and Co., Limited, of Stourbridge), is to be competed for annually. Mr. Mellor has invited the members to play the competition next year on his links at Stourbridge.

We learn from the "Financial News" that at the recent meeting of the Directors of the Mannesmann Roehren Werke, the balance-sheet for the year ended June 30 last, was presented. The returns of the German works showed an increase from 37,763,587 marks to 46,216,669 marks; while the total returns of all works at home and abroad belonging to the Mannesmann concern amounted to 72,136,787 marks, compared with 61,921,373 marks last year. Of the net profit—3,831,271 marks against 3,944,461 marks (the sum brought forward not included)—191,562 marks will be placed to a second reserve which is to be formed, 2,812,500 marks will be paid as a dividend of 12½ per cent. on the old shares, and 468,750 marks as a dividend of 6¼ per cent. on the new shares. The sum carried forward to next year's accounts is 808,014 marks. The prospects for the new year were stated to be favourable.

In the last number of the "JOURNAL" (p. 761), reference was made to a successful exhibition of gas cooking and heating appliances which had been held in the Town Hall, Burton-on-Trent. In connection with it, cookery demonstrations were given by Miss E. M. Smith, who, as already stated in our columns, has been engaged by the Gas Committee of the Corporation specially for this purpose. At the close of one of the demonstrations, a suggestion was made that a brief *résumé* of the lectures would be useful to ladies who had not always been able to see and hear all that was going on, as well as to others who had been prevented from getting to the Town Hall. In compliance with this suggestion, Miss Smith prepared some useful notes on "How to Use a Gas Cooking-Stove to the Best Advantage;" and they appeared in the "Burton Evening Gazette" last Wednesday. They occupy nearly a column, and include not only hints as to properly using a gas-stove, but remarks on paper-bag cookery, recipes for afternoon tea scones, milk rolls, and maids of honour—of much use in the household.

## GAS COMPANIES' STOCK AND SHARE LIST.

**Referred to on p. 794.**

| Issue. | Share. | When ex-Dividend. | Dividend or Dividend & Bonus. | NAME. | Closing Prices. | Rise or Fall in Wk. | Yield upon Investment. |
|---|---|---|---|---|---|---|---|
| £ | | | p.c. | | | | £ s. d. |
| 1,551,868 | Stk. | Apl. 12 | 5 | Alliance & Dublin Ord. | 81—84 | .. | 5 19 1 |
| 374,000 | Stk. | July 14 | 4 | Do. 4 p.c. Deb. | 93—95 | .. | 4 4 3 |
| 250,000 | 5 | May 12 | 7 | Bombay, Ltd. | 6¼—6⅜ | .. | 5 3 8 |
| 50,000 | 10 | Aug. 31 | 15 | Bourne- ) 10 p.c. | 28⅝—29½ | .. | 5 1 8 |
| 311,810 | 10 | ,, | 7 | mouth Gas ) B 7 p.c. | 16¼—16½ | .. | 4 3 7 |
| 75,000 | 10 | ,, | 6 | and Water ) Pref. 6 p.c. | 14¼—14½ | .. | 4 1 4 |
| 380,000 | Stk. | Aug. 16 | 13 | Brentford Consolidated | 256—261 | .. | 4 19 7 |
| 330,000 | ,, | ,, | 10 | Do. New | 198—203 | .. | 4 18 6 |
| 50,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. | 120—122 | .. | 4 2 0 |
| 206,250 | ,, | June 15 | 4 | Do. 4 p.c. Deb. | 97—99 | .. | 4 0 10 |
| 220,000 | Stk. | Aug. 31 | 11 | Brighton & Hove Orig. | 216—221 | .. | 4 19 7 |
| 246,320 | ,, | ,, | 8 | Do. A Ord. Stk. | 156—159 | .. | 5 0 8 |
| 490,000 | 20 | Apl. 12 | 12½† | British | 45½—46½ | −½ | 5 7 6 |
| 120,000 | Stk. | June 30 | 4 | Do. 4 p.c. Deb. Stk. | 94—96 | .. | 4 3 4 |
| 109,000 | ,, | Aug. 16 | 6 | Bromley, A 5 p.c. | 115—120 | .. | 5 0 0 |
| 165,700 | ,, | ,, | 4½ | Do. B 3½ p.c. | 85—90 | .. | 5 0 0 |
| 82,278 | ,, | ,, | 5½ | Do. C 5 p.c. | 105—110 | .. | 5 0 0 |
| 55,000 | ,, | June 30 | 3½ | Do. 3½ p.c. Deb. | 82—84 | .. | 4 3 4 |
| 250,000 | Stk. | ,, | 4 | Buenos Ayres 4 p.c. Deb. | 95—97 | .. | 4 2 6 |
| 100,000 | 10 | — | — | Cape Town & Dis., Ltd. | 2—3 | .. | — |
| 100,000 | 10 | — | — | Do. 4½ p.c. Pref. | 4—5 | .. | — |
| 100,000 | Stk. | June 30 | 4½ | Do. 4½ p.c. Deb. Stk. | 80—83 | .. | 5 8 5 |
| 157,150 | Stk. | Aug. 16 | 5 | Chester 5 p.c. Ord. | 107—109 | .. | 4 11 9 |
| 1,513,280 | Stk. | ,, | 5/9/4 | Commercial 4 p.c. Stk. | 111½—113½ | .. | 4 16 1 |
| 560,000 | ,, | ,, | 5½ | Do. 3½ p.c. do. | 105½—107½ | .. | 4 19 3 |
| 475,000 | ,, | June 15 | 3 | Do. 3 p.c. Deb. Stk. | 76—78 | .. | 3 16 11 |
| 800,000 | Stk. | May 31 | 4 | Continental Union, Ltd. | 86—90 | .. | 4 8 11 |
| 200,000 | ,, | ,, | 7 | Do. 7 p.c. Pref. | 135—137 | .. | 5 2 2 |
| 492,270 | Stk. | — | 5½ | Derby Con. Stk. | 122—124 | .. | 4 8 9 |
| 55,000 | ,, | — | 4 | Do. Deb. Stk. | 104—105 | .. | 3 16 2 |
| 840,150 | 10 | July 28 | 10 | European, Ltd. | 18½—19½ | .. | 5 2 7 |
| 16,160,600 | Stk. | Aug. 16 | 4/14/8 | Gas- ) 4 p.c. Ord. | 106—107 | .. | 4 8 5 |
| 2,600,000 | ,, | ,, | 3½ | light ) 3½ p.c. max. | 83—85 | .. | 4 2 4 |
| 4,062,235 | ,, | ,, | 4 | and ) 4 p.c. Con. Pref. | 101—103 | .. | 3 17 8 |
| 4,531,705 | ,, | June 15 | 3 | Coke ) 3 p.c. Con. Deb. | 79—81 | .. | 3 14 1 |
| 258,740 | Stk. | Sept. 14 | 5 | Hastings & St. L. 3½ p.c. | 94—96* | .. | 5 4 2 |
| 82,500 | ,, | ,, | 6½ | Do. do. 5 p.c. | — | .. | — |
| 70,000 | 10 | Apl. 27 | 11 | Hongkong & China, Ltd. | 17½—18 | .. | 6 2 2 |
| 131,000 | Stk. | Sept. 14 | 7½ | Ilford A and C | 147—150* | .. | 5 0 0 |
| 65,780 | ,, | ,, | 6 | Do. B | 120—123* | +1½ | 4 17 7 |
| 65,500 | ,, | June 30 | 4 | Do. 4 p.c. Deb. | 94—96 | .. | 4 3 4 |
| 4,940,000 | Stk. | May 12 | 9 | Imperial Continental | 180—183 | .. | 4 18 4 |
| 1,935,000 | Stk. | Aug. 16 | 3½ | Do. 3½ p.c. Deb. Red. | 90—92 | .. | 3 16 1 |

| Issue. | Share. | When ex-Dividend. | Dividend or Dividend & Bonus. | NAME. | Closing Prices. | Rise or Fall in Wk. | Yield upon Investment. |
|---|---|---|---|---|---|---|---|
| £ | | | p.c. | | | | £ s. d. |
| 200,242 | Stk. | Aug. 31 | 6 | Lea Bridge Ord. 5 p.c. | 118—120 | .. | 5 0 0 |
| 561,000 | Stk. | Aug. 16 | 10 | Liverpool United A. | 212—214 | +2 | 4 13 6 |
| 718,100 | ,, | ,, | 7 | Do. B. | 162—164 | +½ | 4 5 4 |
| 306,083 | ,, | June 30 | 4 | Do. Deb. Stk. | 102—104 | .. | 3 16 11 |
| 75,000 | 5 | June 15 | 6 | Malta & Mediterranean | 4⅜—5 | .. | 6 0 0 |
| 560,000 | 100 | Apl. 1 | 5 | Met. of ) 5 p.c. Deb. | 101—103 | .. | 4 17 1 |
| 250,000 | 100 | ,, | 4½ | Melbourne ) 4½ p.c. Deb. | 101—103 | .. | 4 7 5 |
| 541,920 | 20 | May 31 | 3½ | Monte Video, Ltd. | 12⅜—13½ | .. | 5 5 8 |
| 1,775,892 | Stk. | July 28 | 4½ | Newc'tle&G'tesh'd Con. | 103—105 | .. | 4 3 4 |
| 529,705 | Stk. | June 30 | 3½ | Do. 3½ p.c. Deb. | 87—89 | .. | 3 18 8 |
| 55,940 | 10 | Aug. 31 | 7/7/0 | North Middlesex 7 p.c. | 14½—15½ | .. | 4 10 4 |
| 300,000 | Stk. | Apl. 27 | 8 | Oriental, Ltd. | 138—140 | .. | 5 14 4 |
| 60,000 | 5 | Apl. 12 | 8 | Ottoman, Ltd. | 6⅞—7½ | .. | 5 10 4 |
| 31,800 | 53 | Aug. 16 | 13 | Portsea Island A | 132—136 | .. | 5 1 0 |
| 60,000 | 50 | ,, | 13 | Do. B | 122—125 | .. | 5 4 0 |
| 100,000 | 50 | ,, | 12 | Do. C | 117—122 | .. | 4 18 4 |
| 398,490 | 5 | May 31 | 8 | Primitiva Ord. | 7⅛—7½ | .. | 5 6 8 |
| 796,980 | 5 | June 30 | 5 | Do. 5 p.c. Pref. | 5 7/16—5 7/16 | −1/16 | 4 11 11 |
| 488,900 | 100 | June 1 | 4 | Do. 4 p.c. Deb. | 97—99 | .. | 4 0 10 |
| 312,650 | Stk. | June 30 | 4 | River Plate 4 p.c. Deb. | 95—97 | .. | 4 2 6 |
| 250,000 | 10 | Mar. 24 | 12† | San Paulo, Ltd. | 21¼—22½ | .. | 5 6 8 |
| 115,000 | 10 | ,, | 6 | Do. 6 p.c. Pref. | 12—12½ | .. | 4 16 0 |
| 125,000 | 50 | July 1 | 5 | Do. 5 p.c. Deb. | 50—51 | .. | 4 18 0 |
| 135,000 | Stk. | Aug. 31 | 10 | Sheffield A | 237—239 | +2 | 4 3 8 |
| 209,984 | ,, | ,, | 10 | Do. B | 237—239 | +2 | 4 3 8 |
| 523,500 | ,, | ,, | 10 | Do. C | 235—237 | .. | 4 4 5 |
| 70,000 | 10 | June 15 | 7 | South African | 8¾—9½ | .. | 7 7 4 |
| 6,429,895 | Stk. | Aug. 16 | 5/9/4 | South Met., 4 p.c. Ord. | 116—118 | .. | 4 12 8 |
| 1,895,445 | ,, | July 14 | 3 | Do. 3 p.c. Deb. | 78½—80½ | .. | 3 14 6 |
| 209,820 | Stk. | Aug. 16 | 8½ | South Shields Con. Stk. | 150—152 | .. | 5 11 10 |
| 605,000 | Stk. | ,, | 5⅝ | S'th Suburb'n Ord. 5 p.c. | 117½—119½ | .. | 4 14 9 |
| 60,000 | ,, | ,, | 5 | Do. 5 p.c. Pref. | 115½—117½ | .. | 4 5 1 |
| 117,058 | ,, | July 14 | 5 | Do. 5 p.c. Deb. Stk. | 121—123 | .. | 4 1 4 |
| 502,310 | Stk. | May 12 | 5 | Southampton Ord. | 108—110 | .. | 4 10 11 |
| 120,000 | Stk. | Aug. 16 | 7½ | Tottenham ) A 5 p.c. | 145—148 | .. | 4 16 3 |
| 483,940 | ,, | ,, | 5⅝ | and ) B 3½ p.c. | 115—117 | +1 | 4 16 1 |
| 149,470 | ,, | June 15 | 4 | Edmonton ) 4 p.c. Deb. | 96—98 | .. | 4 1 8 |
| 182,380 | 10 | June 15 | 8 | Tuscan, Ltd. | 8⅞—9¼ | .. | 8 13 0 |
| 149,900 | 10 | July 1 | 5 | Do. 5 p.c. Deb. Red. | 96—98 | .. | 5 2 0 |
| 236,476 | Stk. | Aug. 16 | 5 | Tynemouth, 5 p.c. max. | 113—115 | .. | 4 6 11 |
| 255,636 | Stk. | Aug. 31 | 6⅞ | Wands- ) B 3½ p.c. | 142—145 | .. | 4 14 10 |
| 85,766 | ,, | June 30 | 3 | worth ) 3 p.c. Deb. Stk. | 71—73 | .. | 4 2 2 |

Prices marked * are "Ex. div."

† Next dividend will be at this rate.

## TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending Sept. 23. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

| Article. | Basis. | London. | North-East Coast. | East Coast, Yorks. | West Coast. | | Glasgow. |
|---|---|---|---|---|---|---|---|
| | | | | | Liverpool. | Manchester. | |
| Tar, crude | per ton | — | 20/– 25/6 | 21/– 25/– | — | 21/– 25/– | — |
| Pitch | „ | 42/6 | 40/– | 40/– | 40/– | 39/6 | 40/– |
| Benzol, 90% | per gallon | 1/– | –/10 | –/9½ | –/9¼ | –/9¼ –/9½ | –/9⅜ |
| Benzol, 50-90% | „ | — | –/10 | –/9 | — | –/9 | –/9¼ |
| Toluol, 90% | „ | — | –/10 –/10½ | –/9 | –/10 | –/10 | –/10 |
| Crude naphtha, 30% | „ | — | –/4¼ | –/3⅜ | –/3⅜ | –/3⅜ | — |
| Light oil, 50% | „ | — | –/3½ | –/3½ –/3¾ | –/3½ | –/3½ –/3¾ | — |
| Solvent naphtha, 90-160 | „ | — | –/10 –/10½ | –/10 | –/10 | –/10 | –/11 |
| Heavy naphtha, 90-190 | „ | — | –/11 | –/11 | –/11¼ | –/11¼ | –/11 |
| Creosote in bulk | „ | –/2⅜ –/2⅞ | –/2¼ | –/2⅛ | –/2⅛ | –/2⅛ –/2¼ | –/2 |
| Heavy oils | „ | — | –/2⅛ –/2⅝ | –/2¼ | –/2¼ | –/2¾ | –/2¾ |
| Carbolic acid, 60's | „ | 2/4 | 2/2 | 2/3 | — | 2/1 | 2/2 |
| Naphthalene, crude drained salts | per ton | — | 43/9 | 42/6 | 47/6 | 47/6 50/– | — |
| „ pressed | „ | — | 60/– | 63/– | 60/– | 60/– 72/6 | — |
| „ whizzed | „ | — | — | — | 70/– 72/6 | 65/– 75/– | 62/6 |
| Anthracene | per unit | –/2 | –/1½ | –/1½ | –/1¼ | –/1¼ | — |

## WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

### Appointments Vacant.

GAS ENGINEER (as Representative). No. 5441.
MANAGER (Chili). No. 5453.
ASSISTANT CHEMIST. No. 5447.
DISTRIBUTION DEPARTMENT. No. 5445.
GAS-FITTERS. Bolton Corporation Gas-Fittings Department.
TRAVELLER OR REPRESENTATIVE. "J.," 41, Ashford Road, Cricklewood.

### Appointments Wanted.

CHEMICAL PLUMBER. No. 5450, c/o Mr. King, 11, Bolt Court, Fleet Street, E.C.
EXPERIENCED ORGANIZER, &c. No. 5451.

### Agencies Wanted.

BY ENGINEER AND ENGINEERING FIRMS. No. 5446, No. 5449, and No. 5452.

### Plant, &c. (Second-Hand), for Sale.

EXHAUSTER, &c., AND TAR-EXTRACTOR. Mr. J. Hawksley, Great Yarmouth.
INCANDESCENT LAMPS, &c. Paragon Works, Shepherd's Bush.
PURIFIERS, &c. W. J. Jenkins and Co., Retford.

### Plant, &c. (Second-Hand), Wanted.

GASHOLDER, &c. No. 5448.

### Factory to Let (London).

Box 6414, c/o Willings.

### Stocks and Shares.

ANNFIELD PLAIN GAS COMPANY. By Auction. Oct. 5.
DARTFORD GAS COMPANY. By Auction. Oct. 3.
EAST GRINSTEAD GAS AND WATER COMPANY. By Auction. Oct. 3.
SOUTH KENT WATER COMPANY. By Auction. Oct. 3.
SOUTHEND WATER-WORKS COMPANY. By Auction. Oct. 3.
WOKING WATER AND GAS COMPANY. By Auction. Oct. 17.
WORTHING GASLIGHT AND COKE COMPANY. By Auction. Oct. 17.

### TENDERS FOR

### Oxide.

SALFORD GAS DEPARTMENT.

### Storage Hoppers, Conveyors, Generating Plant for Stoking Machinery, and Alterations, &c.

PERTH GAS DEPARTMENT. Tenders by Oct. 14.

### Sulphuric Acid.

LEICESTER GAS DEPARTMENT. Tenders by Oct. 7.

## NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

*No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.*

**COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.**

**Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.**

**Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.**

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All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
**Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.**


**OXIDE OF IRON.**

**O'NEILL'S OXIDE**
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

**SPENT OXIDE PURCHASED IN ANY DISTRICT.**

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

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**"VOLCANIC" FIRE CEMENT.**
Resists 4500° Fahr. Best for GAS-WORKS.
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Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

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*General Manager (for England and Wales)*—
W. T. P. CUNNINGHAM,
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*General Manager (for Scotland)*—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

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SPENT OXIDE PURCHASED.
**BALE'S FIRE CEMENT.**
**PAINT FOR GAS-WORKS.**
**"KLEENOFF," THE COOKER CLEANER.**
**BALE & CHURCH, LTD.,**
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**SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.**
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with which is amalgamated WM. PEARCE & SONS, LTD.
86, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
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Telephone: 1588 AVENUE (3 lines).

**D. ANDERSON AND COMPANY,**
GAS LIGHTING ENGINEERS AND CONTRACTORS,
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "DAYLIGHT, LONDON." Telephone: 2336 HOLBORN.